













## Downtime by Chad

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complex but easier to use programming languages will have to be developed to cut programming time. He argues that, while the development of such languages will place a heavy demand on language designers, the end results could mean that programming will require less systems know-how but more understanding of the user world.

# Time for a change in language design

By Dr Richard Stevens

COMPARED with the striking changes caused by the microelectronics revolution, the stability and longevity of the commonly used languages is astonishing. It is like using quill pens for line printers. The two most used languages are Cobol and Fortran, with the business usage of Cobol swamping all other languages.

Both of these hoary old veterans were conceived in the days of small core machines with cherished antiquities like magnetic drums, cards and paper tape. In part, this survival is a tribute to the original architects of the languages, but it also reflects conservative attitudes in the computer world. The training of a programmer is such a long and painful business and staff turnover is high that there is considerable pressure for standardisation in language usage.

The pressure for machine-independent high-level languages will not come from established computer manufacturers. This is shown by the disparity between the great efforts they make to develop hardware and operating systems and their niggling efforts in language theory. The reasons are fairly obvious.

The investment in software, both in the form of programs and understanding of a range of computers and their operating systems, makes it difficult for an organisation to make a radical break from a manufacturer.

The new VAX computer from Digital Equipment was designed to run all PDP-11 software and to introduce the standard com-

mand language to all DEC machines and operating systems. Very laudable aims too, but they have the distinct commercial advantage of locking the customer even more tightly to the manufacturer. If truly machine transferable languages and operating systems arrive then it will not be in the commercial interest of larger manufacturers.

However, technological changes will create economic pressure for new languages. During most of the past 20 years it has been more important to save computer time than programmer time. The common languages reflect this — they are oriented towards assembly language routines rather than languages such as Pascal, which use techniques more akin to algorithm-solving.

The significant change wrought by microelectronic technology in the last few years is to make the machine much cheaper than the people who operate it. A Megabyte of memory can be bought for £10,000, less than the cost of a man-year of effort. In 1988 this memory will cost less than £100.

Today, for £5,000, it is possible to buy a processor that would have cost several hundred thousand pounds 10 years ago (all prices are expressed in 1978 terms). If each system needed three programmers (at £10,000 expenses per annum) to run it for its assumed five-year lifetime, then the programmers cost only 15% of the machine cost in 1968, but 3,000% of the machine cost in 1978. The machine is a small and declining fraction of the total cost.

These trends are so striking that any argument about the details of the assumptions is irrelevant. If any substantial inroads are to be made on the computing cost, then they must be made by savings on the programming, even if a more powerful machine is required because of programming inefficiencies.

This in turn indicates that more complex languages must be used in order to cut programming time. The amount of core a language occupies and, to a limited extent, the execution time of the program are secondary factors. The languages must be fully interactive and interpretative rather than compiling. The extent of the inefficiency of coding that can be tolerated can easily be derived from cost analysis of different machines.

For example, DEC produces a range of machines from the single card LSI-11 to the new VAX, which offers mainframe performance for the cost of a large minicomputer a year or two ago. The results of a timing test given to the DEC range are shown in the graph. As a matter of interest, by 1988 the whole graph will have disappeared off the left hand axis. The graph shows that in order to produce a tenfold increase in speed there is a tenfold increase in price.

Suppose, therefore, that we have a new programming language which is five times less efficient in program execution but only takes half the time to develop programs. Rather than buy a 10,000 machine which will involve 200,000 words of pro-

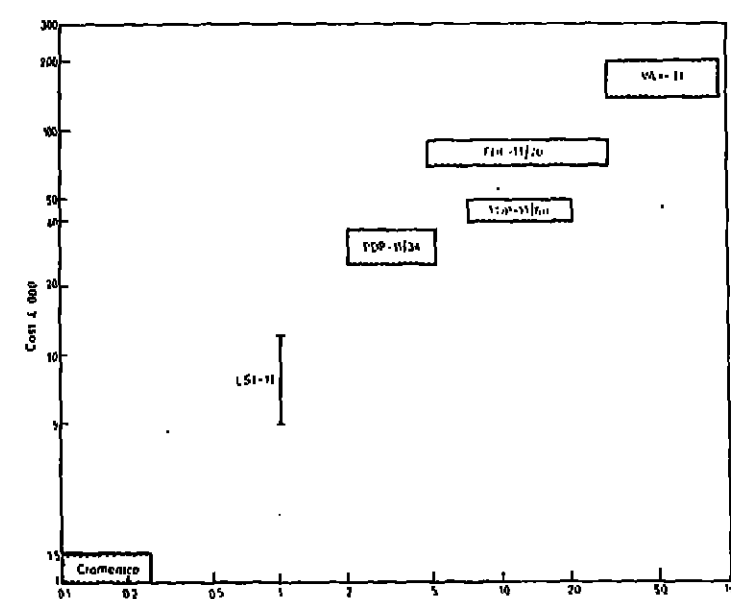


Figure 1: The graph plots the speed of various machines (1 = speed of LSI-11) against the cost — both of logarithmic scales. The edges of the boxes are: Cromemco: cost £1,500 to £2,000, speed 0.1 to 0.25; LSI-11: cost £5,000 to £12,000, speed 1; 11/34: cost £25,000 to £35,000, speed 2-5; 11/80: cost £40,000 to £50,000, speed 7-20; 11/70: cost £70,000 to £90,000, speed 5-30; and VAX: cost £150,000 to £200,000, speed 30-90.

gramming effort, it would be more sensible to buy a machine at £25,000 (which will execute the programs as fast in the new language) and save £75,000 in programming cost.

Of course, this is trivial abstraction and there are many other factors, not least human nature, to be considered.

Shortage of programmers (or to put it another way, unwillingness to pay programmers enough) and time constraints on program development will also encourage new languages. Investment in old programs, multiple use of programs and equipment will likewise discourage such a new language.

The results of the above logic are already to be seen in the microprocessor world. If we examine small general purpose systems based on microprocessors (very similar in power to PDP-8s, but cheaper and more convenient) the language that is available for every system is Basic. S-100 bus based systems costing between £500 and £2,000 are good examples.

Obviously when these, or other systems like Intel's Intelic, are used to develop software for £20 dedicated processors a lower level language must be

used. The expansion of such work will ensure a continuous demand for assembly language programmers for some time.

The reasons that Basic is so popular in these machines include:

1. It is interpretative rather than compiling. This probably speeds up the development of programs by three to four times compared with Fortran.
2. It is very easy to learn and operate. It is based on the English language and it is not necessary to learn editing codes to start.
3. It is fully interactive: Basic can be halted in midstream, variables examined, altered and the program restarted. Print statements for debugging can be added in seconds.
4. It is oriented towards VDU operation rather than printed output. Debugging compiled programs always seem to mean reams of printout for program debugging.

The last two or three years have seen striking developments in the language. The original versions used small amounts of core (4K or 5K bytes). Now, reflecting the fact that 32K bytes of memory can be obtained for £800, the interpreters are much more comprehensive, having

almost all the facilities of Fortran while retaining the original advantages of the language.

For example, Cromemco extended Basic takes 16K bytes of memory, and a great deal of thought has gone into improving the speed of the language. Each line is interpreted and coded after being typed, i.e. the language is a semi-compiling hybrid. This has the advantage that syntax errors are detected immediately, while the line is fresh in the mind.

Furthermore, the line is interpreted only once instead of every time it is encountered on a loop. Other excellent facilities include 14-digit accuracy arithmetic, integer arithmetic, dynamic error trapping, good input/output facilities and complex formatting capabilities — all attained without the loss of the flexibility of an interpretative language.

Despite all this, Basic is a far from elegant language and is especially weak compared with Pascal in terms of expression of algorithms. If we imagine the powerful machines available for program development in a few years' time, with say 1 Megabyte and processor contained within your terminal, and access to 100 Mbytes more in your local mind, then the real difficulty is the effort that will be needed to generate languages that will use this power as efficiently as possible.

What is required is a language able to evolve, rather like human language, with local dialects of its own but with the correct structure to enable evolutionary changes to take place.

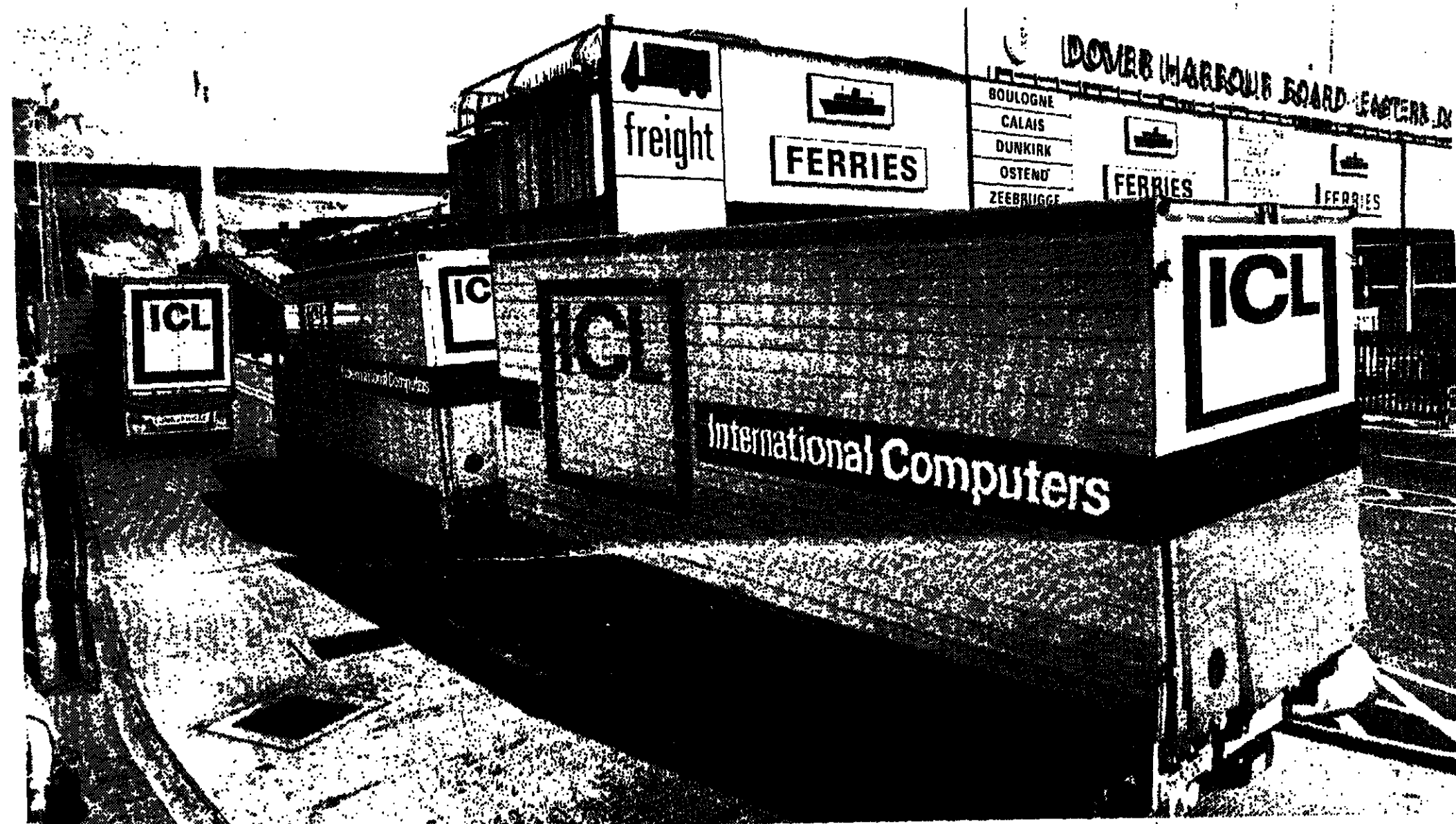
The bulk of programmers will then be able to write programs that require creativity but less system knowledge and skill. In any case the shortage of programmers will make this a necessity.

The "languages" they use will be looked on with contempt by the old-timers who have struggled through Hollerith cards, overlays and 40K byte systems.

In a sense, when the time for a program has been written, then the creative process is finished. It will be the job of the next generation of language writers to create the structure to turn this pleasant dream into reality.



In 1968 ICL meant little to continental Europe.

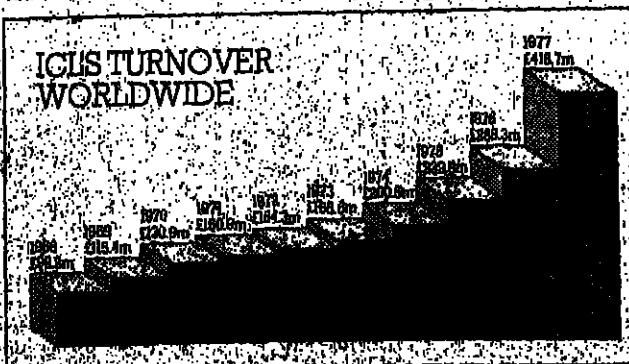


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In the world as a whole we operate in 86 countries. Over 50% of our production goes for export. Within 5 years we expect the proportion to have grown to 70% and our output, making an even greater

contribution to Britain's balance of trade. Ten years ago, ICL was scarcely known outside the United Kingdom. Today it is recognised as a significant force in world computing. It is an achievement we can all be proud of.



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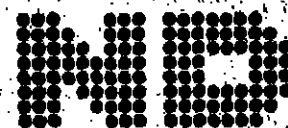
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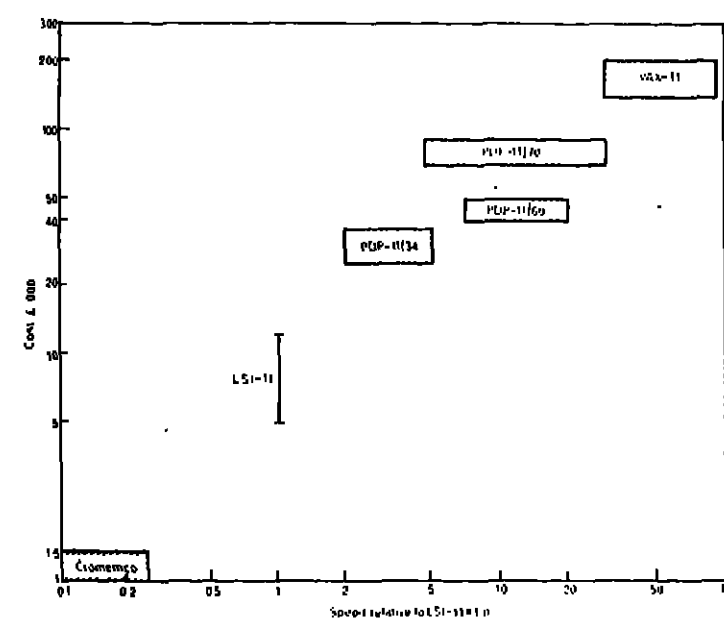


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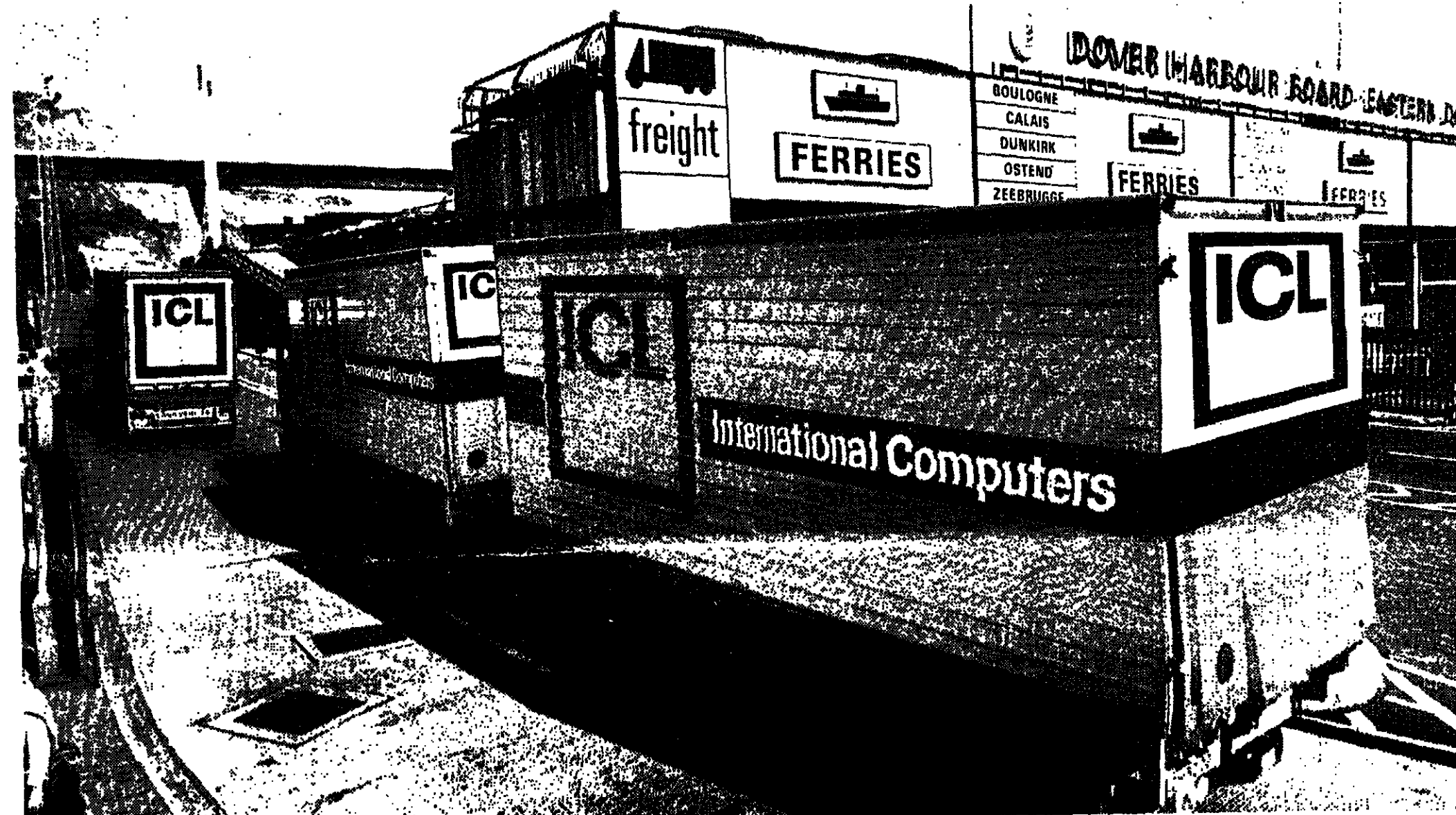
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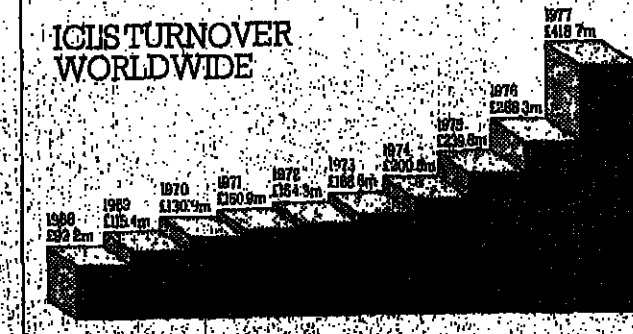


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# MICHIE'S PRIVATEVIEW

## Why AI looks different in California



THIS land of ours nourishes an old, old culture, as we are fond of reminding ourselves. We are even fonder of reminding visiting Americans, usually as an excuse for the absence or non-working state of the technical under-pinnings of life from toilets and refrigerators to portable electric typewriters.

But when this is made an excuse for our being obtuse, backward, doltish, phillistine and conspicuously self-defeating about the new computer-oriented culture which is arising in the world, then it is hard to accept sheer age as our permanent excuse.

In this I find myself in sympathy with the 104-year-old man whose visit to his doctor was recently described to a San Francisco convention by my former colleague, Alex Comfort, best known for the book with the nice drawings, "The joy of sex."

The doctor smiled benignly and said: "That knee is 104 years old. You're going to have to expect a little arthritis!" At this point the patient indignantly replied, "Well, my other knee is 104, too, and it doesn't hurt a bit. Now, do something!"

In something like this style, when one attempts to discover why post-graduates and post-doctorals in UK universities have to go to the US if they want hands-on experience of certain growing-points, the feeling seems to be: That's all right. America's a young, hustling, noisy place, with its

own brand of football and its own brand of innovation. We wouldn't necessarily want any of that here! At our age we must expect a little educational arthritis.

Here at Stanford University, where I am teaching an artificial intelligence course for the Autumn term, the landscape leaps with numerous extraordinary activities, centred on the computer-based future.

Colleagues in the university collaborate with others at Stanford Research Institute on a vast intelligent database containing the whereabouts and vital statistics of some tens of thousands of ships in the Pacific, to be interrogated by Navy personnel in natural language.

At the Xerox Palo Alto Research Center, a stone's throw from the university, the outlines of tomorrow's office automation systems are taking shape — robot secretaries smart enough to plan meetings, make and cancel appointments, and explain their actions.

Ed Feigenbaum's heuristic programming project is, of course, familiar to Privateview readers as the source of such "expert systems" as Dendral for chemistry and Mycin for clinical pathology and pharmacology. The latest system, Molgen, will put a super-charger into genetic engineering. Watch this space.

Ten miles from the campus stands John McCarthy's artificial intelligence project, where students visit Tom Binford's system for robot vision, and McCarthy ponders the formal logic of how a robot knows that he knows that you know what she knows....

There, too, you may see the fruits of the world's most advanced system for computer-aided typography. Half-way through the fourth volume of his monumental "Art of computer programming" the great D. E. Knuth found that his regular printer was not able to deliver to the needed specs. To universal astonishment he forthwith applied himself for 10 hours per day to programming a system to do the job.

Truly there is something in the air, and not confined to the West Coast, which seems to mitigate against sleepiness. At a Boston panel session dealing with "Artificial intelligence and science fiction" the founder of MIT's AI Laboratory, Marvin Minsky, said: "Some people think science fiction is a narrow speciality within general literature. But I say general literature is a narrow speciality of science fiction. While mainstream fiction deals with a few eternal problems, science fiction is not limited in time, space or theme."

"Science fiction is the only non-technical area of human thought that deals with artificial intelligence."

Many will say that that's just where artificial intelligence belongs. It looks different here in California.

## SOFTWARE FILE-1

# Screen formatting help for HP3000s

SCREEN formatting software to help users develop data entry applications has been introduced by Hewlett-Packard for its HP3000 systems. Called View/3000, the package can operate either as a stand-alone data entry system or as an adjunct to application programs.

The package enables a user to build menu-style forms while working at a VDU. At the same time, he can define format and editing characteristics for each field on the form. A wide variety of editing routines can be specified in the way, including for example table look-up.

The input parameters thus established are stored in "compiled" form in a Ksam disc file and are subsequently used to control the execution of a general purpose screen input program.

In addition to functioning as a stand-alone data entry system, collecting data for later batch processing, the software can also form a front-end interface for transaction processing.

## Extra facilities for Series IV

EXTRA facilities for Series IV, the interactive development system for data entry and inquiry on the PDP-11, have been announced by Geneva-based Informatic SA. One special feature called "Extended processing interface" enables Series IV to be used as the front-end processor for applications requiring real time updating of files and databases. Other changes have reduced file sizes by up to 80%, and improved interactive debugging tools.

The product is Tone-3, a high performance interactive timesharing system which is essentially an implementation of TSO for OS/VS1, and runs for £800 a month in the UK.

The responsibility of marketing Tone-3 in Europe was assumed by European Software Co. earlier this year (CW, June 29). Since then 25 sales have been made and the list of users is growing almost daily. Earlier this week two Scandinavian companies became the first Tone users in their part of the world; other users are situated in West Germany, France, Belgium and Eire, though there are as yet none in the UK.

Tone was developed by Tone Software Co., based in Anaheim, California, and active only in the US until it concluded its agreement with the European Software Co. Its first sale in Europe, however, dates back as far as 1975.

This customer was Belgische Boerenbond, a Belgian farmers' co-operative which has long been a leading IBM user, and earlier this year became the first Belgian customer to take delivery of a 3033. Boerenbond's DP manager, Guido Van Belle, was in London for a conference last week, and he talked to Computer Weekly about his experiences with Tone.

Van Belle learnt about Tone in the usual way, from a press report. The claim that it would

perform a TSO function under VS1 interested him, so he took the trouble to contact the supplier direct in Anaheim, and arranged to go on their standard course. "What opened my eyes was that this course taught me how VS1 really functions. I had been able to find no IBM course which did this," he said.

"After that there was a half day session explaining how Tone fitted in, following the IBM standards of knowing and using control blocks. After that I went to a test site, and was finally convinced that I should have it."

"The experience of using a product which was developed and marketed in the US and totally unsupported in Europe proved 'a lot of fun. First of all there is a nine hour time gap between Brussels and California, so my initial calls were at always waking somebody up at 4am, which didn't make me very popular. Once we'd sorted out a means of communication, however, everything went well."

"It took time to get the system operational. After six months, and with five system/programmer terminals connected, we got our first user on. There are now about 25, and there've been no problems at all in the past 12 months."

"An advantage that ought to be mentioned is that Tone allows the users to orient his development towards how he is operating under MVS, so he requires minimal changes at that stage. This is in conjunction with another Tone Software product, ISP, or Inter-Spool Processor, which allows multiple CPU systems to share facilities."

Terminals, forms, and files can be controlled using View/3000 from user programs written in Cobol, Basic, RPG, or SPL — HP's Algol-based systems implementation language. A data reformatting facility is included in the package to ease the transition from existing application program methods.

Screen handling software has appeared increasingly over recent years, usually as part of a transaction processing monitor. It was a feature for example of interdata's Itrac TP monitor, announced last year (CW, December 8, 1977), and has also been recently added to Altergo's Shadow II.

A Hewlett-Packard spokes-

man pointed out that no TP package is offered on the HP3000, which "provides all the usual features of a TP monitor as part of the operating system."

View/3000 in this respect would appear to resemble the KDSS and Tam packages which provide similar facilities under RSTS/E on Digital Equipment's PDP-11 (Software File, April 6).

View/3000 is priced at £50 per month, with an initial fee of £1,000. The spokesman noted, however, that HP's Ksam/3000 access method (CW, February 10, 1977) is a prerequisite to use of View/3000 so that potential users without Ksam would have to buy both packages.

# Why European IBM users are attracted to Tone-3

EUROPEAN users of large IBM mainframes are being attracted in bulk to an American software product which was largely unknown on this side of the ocean only a few months ago.

The product is Tone-3, a high performance interactive timesharing system which is essentially an implementation of TSO for OS/VS1, and runs for £800 a month in the UK.

The responsibility of marketing Tone-3 in Europe was assumed by European Software Co. earlier this year (CW, June 29). Since then 25 sales have been made and the list of users is growing almost daily. Earlier this week two Scandinavian companies became the first Tone users in their part of the world; other users are situated in West Germany, France, Belgium and Eire, though there are as yet none in the UK.

Tone was developed by Tone Software Co., based in Anaheim, California, and active only in the US until it concluded its agreement with the European Software Co. Its first sale in Europe, however, dates back as far as 1975.

This customer was Belgische Boerenbond, a Belgian farmers' co-operative which has long been a leading IBM user, and earlier this year became the first Belgian customer to take delivery of a 3033. Boerenbond's DP manager, Guido Van Belle, was in London for a conference last week, and he talked to Computer Weekly about his experiences with Tone.

Van Belle learnt about Tone in the usual way, from a press report. The claim that it would

perform a TSO function under VS1 interested him, so he took the trouble to contact the supplier direct in Anaheim, and arranged to go on their standard course. "What opened my eyes was that this course taught me how VS1 really functions. I had been able to find no IBM course which did this," he said.

"After that there was a half day session explaining how Tone fitted in, following the IBM standards of knowing and using control blocks. After that I went to a test site, and was finally convinced that I should have it."

"The experience of using a product which was developed and marketed in the US and totally unsupported in Europe proved 'a lot of fun. First of all there is a nine hour time gap between Brussels and California, so my initial calls were at always waking somebody up at 4am, which didn't make me very popular. Once we'd sorted out a means of communication, however, everything went well."

"It took time to get the system operational. After six months, and with five system/programmer terminals connected, we got our first user on. There are now about 25, and there've been no problems at all in the past 12 months."

"An advantage that ought to be mentioned is that Tone allows the users to orient his development towards how he is operating under MVS, so he requires minimal changes at that stage. This is in conjunction with another Tone Software product, ISP, or Inter-Spool Processor, which allows multiple CPU systems to share facilities."

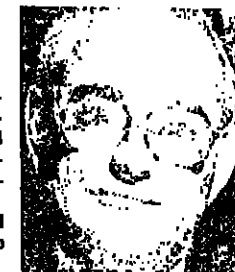
But is it (CW)

## SOFTWARE FILE -2

# Len Griffiths joins Gamma board

LEONARD Griffiths, founder of the software consultancy Leonard Griffiths & Associates and formerly head of computing services at Rolls-Royce, has joined the board of Gamma Associates. He takes up the position of Commercial Director, based at the company's Nottingham headquarters.

Griffiths (pictured right) was responsible for the formation and management of the Rolls-Royce computer services subsidiary Systems International which was dismantled in 1971 following the financial collapse of Rolls-Royce.



Prior to his appointment to the board of Gamma, he had been advising the group as a marketing consultant.

# 'Insulate users further from system changes'

A MAJOR aim of Cincom's Total Information System (CW, October 12) is to insulate the user still further from the effects of hardware or software change that does a traditional DBMS.

Cincom is also explicitly aiming to meet the needs of distributed database systems.

The key component in these plans is the implement of the TIS Data Directory. Via the directory, both end-users and application programs can access data items regardless of the structure and location of the physical database or databases.

This is because the directory, a "total inventory of data items," provides an integral source of information about the characteristics, location, and usage of each data item. Using this information, the TIS software can itself determine a navigation strategy to meet specific data requests.

The system can thus offer a single, transparent access point for data held in different databases, including databases held on different machines.

A possible pointer to the specific distributed database architecture envisaged by Cincom is the fact that the company is well down the road with the implementation of Total for IBM's Series I minicomputer.

However an interesting aspect

of TIS is that it offers independence from the database management system itself in addition to independence from database design.

While the initial releases of TIS will be built on a version of the existing IBM mainframe Total, an alternative DBMS could be used as the "driving engine" of TIS in the future. While announcing the system, Cincom hinted repeatedly that such a replacement DBMS could be relational in type.

The company was also keen to note that its "superstructure" strategy with TIS would further shield applications from the effects of hardware developments, such as microcoded storage devices.

The practical foundation of TIS database independence is a system of progressive mapping, which begins with what Cincom calls a "logical view."

A logical view is a collection of data items that can be manipu-

lated by a specific user group of users. While application programs may by-pass the logical view mechanism, all end-user access is restricted to those items defined in the appropriate logical view.

TIS holds each logical view as a series of Logic Control Blocks (LCBs), which are translated into physical terms by reference to the directory.

Assisting the police

A PROPOSAL for a £12,000 feasibility study by Partel for a command and control system for crime detection has been approved by Greater Manchester Police but it has yet to be passed by the Council.

## PROGRAMMER NOTES

# Now let's get vicious with the supervisors

WHEN in doubt, blame the boss or bad communications. Better still, blame your boss for being a poor communicator.

Hark therefore to the following from a learned article on motivating DP professionals, in the September issue of the American monthly Datamation: "DP people rate supervisor feedback lower than do their counterparts in other professions."

This was one of the conclusions of a survey conducted by J. Daniel Cougar, professor of computer and management science at Colorado University, and Dr Robert Zawacki, an associate professor of a similar ilk at the same university.

The survey took in 800 analysts and programmers and 1,000 in other DP jobs. Like another study published in Datamation based on research carried out by Four-Phase System industrial relations director Dr Jac Fitz-enz (CW, October 12), analysts and programmers turned out to be loners.

That, however, is another story; this week the boot is aimed at the supervisor. Dr Cougar and Zawacki found that DP people gave poor ratings to their satisfaction in having a "knowledge of results" which the Doctors say stems from the failure in supervisor feedback

because DP people expressed the same degree of satisfaction as the rest of the world in the "feedback from the job itself" category.

"It appears that our supervisors are not doing anywhere near as good a job as their peers in other professions in providing feedback to employees," conclude the good Doctors.

The diagnosis is, of course, easier than the cure.

There is, of course, always an instant cure-all. Let Dr Fitz-enz do the prescribing: "More than any other individual and more than another such potent forces as the company itself, the supervisor is the critical element," comments Dr Fitz-enz on the subject.

"Hence it is obvious we should spend more time helping supervisors become good communicators. They are important in both positive and negative situations."

Then comes the inevitable cure-all: "We can achieve the greatest gains by training supervisors at all levels to communicate better."

So, the picture emerging from the studies by the Doctors is of a DP world comprised of self-seeking supervisors supervised by a bunch of ineffectual supervisors. But is it (CW)

# Dutch turnkey deal in offing for PCP

A DUTCH systems house, Holec Control Systems, has bought Software Sciences' Plant Control Package with a view to incorporating it in future turnkey systems.

Initial Holec implementations using PCP are likely to be systems for the food, beverage, petrochemical, and gas industries. These projects will integrate PCP with the company's Prolog range of control hardware.

Subsequently, Holec envisages a much wider range of industrial control applications and will be working with Software Sciences on the development of distributed intelligence control systems.

PCP was originally developed by ICI, which earlier this year licensed Software Sciences to further develop and market the package (Software File, March 2). Systems houses were explicitly identified by the company at that time as a significant market sector.

## IBM 3776 emulation software

SOFTWARE has been announced by Data 100 Corporation which enables any of its remote batch terminal systems to emulate an IBM 3776 using binary synchronous communications protocol.

Due to become available in the first quarter of 1979, the software will operate on systems equipped with a VDU, 4,800 bps BSC communications, and one system and one data diskette.

Commenting that PCP combined ICI's application experience with advanced software technology, Holec identified the package's end-user facilities as a significant factor leading to its selection.

A feature of the package, written predominantly in RPL/2, is a high-level language, Plancol, for direct use by control engineers.

## Merger completed

THE purchase of Insyte Corp by Applied Data Research has been completed (Software File, August 31). The takeover was eventually consummated without shareholder approval following advice from Insyte's lawyers that it was not required.

## Puzzler

THE "props" needed for this week's problem are 11 similar discs, such as draughts, backgammon pieces, coins, etc. Having procured these, mark them with colours in some suitable manner — three Red, three Yellow, three Blue and two Green.

The puzzle is to lay them out flat on a plane surface, with no overlapping, in such a way that each disc touches at least three others (at the circumference) but no disc touches another of the same colour. See page 61 for solution.

# Mail order packs is its aim

SELLING software by mail order is the aim of a small firm recently established in Reading. CHC Software Marketing has developed a technique of selling utility packages by post without any need for travelling by salesman or the customer, and the firm reports surprisingly high response to its mail shots — 14% in one case.

Two products have been marketed so far, both utilities for ICL 1900 or 2900 machines. One is for evaluation of machine performance, plotting graphs of milltime and core usage, and the

other is for high-speed reorganisation of program library files.

Letters were sent to 740 DP managers on a mailing list procured from the NCC, enclosing an evaluation order form to be returned. A free week's trial of the software was provided to those who replied.

Charles Coultas, CHC managing director, points out that the documentation for software sold in this way needs to be very clear and complete, as no support in person is available. All of the programs he is selling at present, more of which are in

the pipeline, were written by his own firm, but he would be interested in selling other people's products as well. "There appears to be an enormous market for commonsense utilities."

## Basic for Datapoint

A NEW version of Basic has been announced by Ventok for its range of Datapoint minicomputers. Called Basicplus, it incorporates several features of the proposed Ansi standard Basic such as transcendental functions, relational operators, logical constants and matrix operations.

Other enhancements include: capacity for longer variable names than hitherto; chaining of programs; more efficient use of memory; compatibility of files with those produced by other Datapoint utilities. Programs written in earlier forms of Basic will continue to work under Basicplus.

## Training centre

A TRAINING and demonstration centre has been opened by software house Pansophic Systems at IJsselstein, near Amsterdam. The centre has terminal facilities linked to a 370/188 at IBM's Dutch Service Centre so that demonstrations of Pansophic's products and customer training can be carried out, as well as product support for the firm's own technicians. Courses are conducted in eight European languages.

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## PEOPLE AND EVENTS

## Wokingham centre for Safe

A COMPUTER centre for the South of England has been established by Safe Computing in Wokingham, Berks. General manager of the centre will be Mike Harrison, who joined the company this year to set up a Southern support operation. The centre will support sales of the company's SafeS production control package, and will also market software services, based on Safe's Solar ledger package for System ten, to small to medium sized industrial organisations.

The address of the new office is Radway House, Molly Millars Lane, Wokingham, Berks, tel: 0734 791212. General manager of Safe Computing's new Wokingham computer centre is Peter Rhodes, formerly a senior consultant.

The West Bromwich centre will offer specialist services for ICL 2900 users plus general commercial systems on a bureau basis.

Kevin Ledger, electronics engineer with Logabax, has been promoted to sales engineer with the OEM division.



Clive Hutchinson, who until recently was computer development manager at East Midlands Gas, has become marketing manager of Adabas Software, and George Geline, previously a systems specialist with Seattle Public Schools, has joined Adabas as a teleprocessing consultant.

Professor J. V. Oldfield has left his post as professor of electrical engineering with University College of Swansea to take up an appointment as professor of electrical and computer engineering at Syracuse University in the US.



Malcolm Richards has moved from Leasco Software, where he was a consultant, to DCC International, where he will be a senior consultant and will also be in charge of the training facility. David Debenham joins DCC as senior consultant, from CMC where he was a project leader.

Tony Evans and Rex Whitaker have been appointed to the board of Systems Reliability. Evans, who was previously marketing manager, becomes marketing director; Whitaker becomes financial director; and both retain directorships in AP Electronics, an associate company of Systems Reliability.

Larry Stock has joined Jensen Computer Systems as a technical support programmer maintaining systems software, from CM&G Life Insurance where he was a programmer. John Cammell has joined Jensen as a trainee programmer.



Pat Muir of Redifon Computers, has been promoted from Southern branch systems manager to systems support training manager, and Steve Richardson, formerly a systems consultant with Donoghue Information Systems, has joined Redifon as systems analyst for the Midlands branch.

John Pennells, former international accountant with the Telex International group, has joined Memorex UK as financial director. William Reed has become area manager for Raytheon Overseas Ltd. He has joined Raytheon from the US Navy, from which he retired with the rank of Captain after serving in the Office of Defence Co-operation.

Nell Stewart has joined RTC as divisional manager for internal and field engineering services. Previously he was director of engineering with Prime.

## Edited by Nancy Pocock



Nearly sixty golfers took part in the CMC Sovereign Golf Tournament played on the Brabazon course near Sutton Coldfield. The players were divided into teams of three, one CMC player and two visitors, and there were prizes for the first six teams, plus individual event trophies. Our picture shows first prizewinners John Nicks (operations manager, Devon County Council), John Groves (operations manager, Somerset County Council) and Tony Horrope (territory manager, CMC, Bristol), with their prize statuettes and golfing bags. Between John Groves and Tony Horrope are CMC Birmingham branch manager David Hughes, who organised the tournament, and CMC chairman Ray Parry.

Iain Oldcorn, who until recently was manager, computing department with the Electricity Council, Millbank, London, has joined Foster Wheeler to take up a newly-created appointment within the computer services department, that of manager of the information systems section. Edward Corell has become vice-president of engineering with Centronics in the US. Most recently he was group engineering manager with Digital Equipment. He replaces David Felton who returns to his previous job as vice-president, quality assurance with Centronics.

## Diablo marketing company

THE floppy disc-based small business system Diablo 3200 from Xerox will be marketed on the South coast and in the Bristol area by a company which has just been formed for the purpose, Gresham Business Computers. The company was formed and will be run by Robert Stevenson, formerly Diablo sales and product manager with the UK distributors.

Business Computer (Systems), Gresham Computer Services of Southampton has a 40% holding. The address of Gresham Business Computers is Perle House, East Street, Southampton, tel: 0703 2220.

● The Liveware cartoon and Soccer results are on page 11.

## DIARY

OCTOBER 25 Viewfinda. Mark Bradshaw, BCS Merseyside branch. Liverpool Polytechnic, 17.45.

OCTOBER 27 Some theoretical issues in language acquisition. Prof H. C. Longue-Higgins, Computation/Linguistics, University of Oxford, Dept of Experimental Psychology, South Parks Road, Oxford, 17.00. Details: Mrs S. M. Hockey, tel: 0865 90721.

OCTOBER 27-NOVEMBER 2 Electronics 78 - electronics fair and seminar. Association of Electronics Manufacturers in Denmark, Bolla Centre, Copenhagen.

OCTOBER 30 X-ray computed tomography. E. Horn, IEE, Survey Place, London WC2, 18.00. Computers in television. Terry Smith, BCS Cheltenham & Glos branch, Queens Hotel, Cheltenham, 18.30.

OCTOBER 31 Computer usage in Grand Prix racing. Dr Karl Kempf, BCS, College of Technology and Design, Blackburn, Lancs, 18.30.

NOVEMBER 1 Using small computers. Study Group on Computers in Survey Analysis, City University, London EC1.

AGM, CMC Users' Association (CUMAC), Winton Stage Hotel, Leicester, 10.30. Details: Maidhead 20023.

The diagnostic electron. Faraday Lecture, IEE Swansea.

Structured program design. William Spence, BCS Edinburgh branch, Mountbatten Bldg, Heriot Watt University, Edinburgh, 17.30.

NOVEMBER 1-2 Sensitivity analysis for computer-aided circuit design, seminar. Robert Spence, Dept of Electrical Engineering, Imperial College, London SW7. Details: Joan Jeffery, 01-589 8111, ext 1470.

Heat exchanger design. Computer Aided Design Centre, Cambridge. Details: Dr P. Winter, Tel: 0223 63125.

NOVEMBER 2 Untapped brainpower the severely disabled can contribute. Neil Rose, BCS Oxford sub-branch, Archery Unit, Stoke Mandeville Hospital, near Aylesbury, Bucks, 18.45.

Interactive engineering design, the inside story. Dr John Kingston, BCS Newcastle branch/IMA, YMCA Bldg, Ellison Place, Newcastle, 18.00.

NOVEMBER 2-3 Programming Group meeting, IBM Computer Users' Association, De Vere Hotel, Coventry.

NOVEMBER 3 How computers look at texts; seminar. S. M. Hockey, Computation/Linguistics, University of Oxford, Dept of Experimental Psychology, South Parks Road, Oxford, 17.00. Details: Mrs S. M. Hockey, tel: 0865 90721.

NOVEMBER 4 Application of microprocessors in telephone exchanges, colloquium. IEE, Savoy Place, London WC2, 18.00. Seminar with display (tel: 2405).

Planning and project resources. Planning techniques. Neil Frobbs, BCS Anglia branch, Thomas Paine Hall, Hatfield, 19.00.

NOVEMBER 7 Experience in the use of computer terminals at the supermarket checkout. Is. Harris, BCS NW London branch, Railway Hotel, Greenford, Middx, 18.30.

Practical approach to installing computers for purchasing and supply. Conference, Institute of Purchasing and Supply, Lancelotti Hotel, Heathrow Airport, London.

Introduction to microprocessors. C. Blake, IEE Hatfield Section, Hatfield Lodge, Hatfield, Herts, 18.30.

Bench marks. BCS Birmingham branch, Priory Dene Hotel, Edgbaston, 18.30.

NOVEMBER 7-8 Minicomputer forum. Bloomsbury Centre Hotel, London WC1.

NOVEMBER 7-10 Pattern recognition, 4th international joint conference. International Association for Pattern Recognition, Kyoto, Japan.

NOVEMBER 8 Computer architecture. Prof Paul Summer, IEE, Savoy Place, London WC2, 17.30.

Future of computing. David Fimes, Association of Independent Clubs Specialists, National Liberal Club, Whitehall Place, London SW1A, 18.00.

Data dictionary systems. Seminar, BCS Data Dictionary Systems Working Party, Imperial College, London SW7, 18.00.

Supersonic evening. BCS Kingston-Thames branch, Regional Management Centre, New Malden, 18.45. Tickets: 01-589 8111, ext 1470.

Micros today. Justin Foidor, BCS London branch, West Lodge Park Hotel, Cockfosters, 18.45.

Visit to NP. BCS Displays Group, Tealdington, Middx, 14.15. Book in advance, 0453 71661, ext 47.

Problems of the computer operator. Forum, BCS Kingston-Thames branch, Regional Management Centre, New Malden, 18.00.

Holography, engineering application. F. N. Birkett, IEE, Dept of Mechanical Engineering, Loughborough University, 18.30.

The role of the computer in team management. D. Hilder, BCS Newcastle branch, Post House, Newcastle, 18.00.

Visit to JCS. BCS Wolverhampton branch, Uttoxeter, Staffs, 18.00. Contact G. Hammer, Wolverhampton 4701.

COPEN, the BCS events policy. BCS Teesside branch, Teesside University, 18.00.

Microprocessors in business. Ted Humphries, BCS, Wulfrun Hall Hotel, Huddersfield, 18.30.

NOVEMBER 11 US Federal computer conference. Sponsored by BCS, 18.00.

## Pricing policy for IBM 8100 software

UK PRICES have not yet been set for the software on the new IBM 8100 (CW, October 12), but the major question of how the pricing policy will work has now become clear.

Users with one 8100 will have to pay standard monthly licence fee — \$150 in the US — for the DPPX native mode operating system. This price includes software maintenance and application of program fixes by IBM. Users with more than one 8100 will have to pay separately for the operating system on each processor. However, they will have a choice. If they want IBM to perform software maintenance at each site, they will have to pay the full licence fee for each copy.

If, however, they are prepared to do the maintenance and fixes themselves, they can opt to pay the full price, with maintenance, at one site, and go for the Distributed Systems Licence Option, DSLO, at all the other sites. DSLO on the DPPX operating system costs \$133 in the US.

DPPX is just one of a portfolio of software offerings with the

8100. Of the rest, probably the most significant is what appears to be a new database management system, about which few details are yet available.

Called DTMS, Database and Transaction Management System, it is said by IBM to be like CICS/VS, which implies that it is a multi-threading system.

Several new hardware units have been introduced on the 8100, and the digit 8 seems to be the prefix number to look out for to identify really new items introduced in future by IBM's DP division — as opposed to the 3730 word-processing system and indeed the 3030 series of mainframes, which are effectively extensions to or new models of existing product lines.

There is a new family of terminals which will eventually succeed the 3270 series. First model is called the 8775, and was developed in the UK. It is microprocessor-controlled, and incorporates 18K-bit memory chips, and features screen partitioning into up to eight segments, field validation, and four levels of highlighting. The

## Ferranti-Inmos link rumours discounted

RECENT speculation on the possibility of the semiconductor operation of Ferranti being merged with Inmos, the NEB's new microelectronics company, were firmly discounted last week by sources close to Ferranti.

The apparent cause of this speculation seems to be the fact that the National Enterprise Board owns Inmos — and 50% of Ferranti.

There are two main reasons why such a merger is unlikely, the sources state. Firstly, the Inmos route of entering the market for high volume standard devices is one that Ferranti has studied, and discarded. The company is understood to want no part of plans that include a head-on clash with major US and Japanese manufacturers.

Secondly, the two are technically incompatible. Though it has an MOS processing capability, Ferranti is primarily operating as a specialist bipolar isolation process.

This incompatibility stifles the one opening for a merger, the opening being followed by GEC

in its venture with Fairchild. This is where a small, specialist device operation can be complementary to high volume standards company. This only holds, however, where there is process compatibility to allow for technology spin-off.

Another factor is Ferranti's discrete component work, a successful operation in manufacturing individual transistors. This would not complement the Inmos drive towards "systems on silicon."

There is of course scope for collaboration and co-operation between the two companies, for Ferranti is building up sales of dedicated peripheral chips for microsystems using its uncommitted logic array technique. This uses an array of logic gates, in chip form, that can be rapidly connected together in any desired configuration by a final metallisation process.

However, as the sources indicate, such collaboration does not require the companies to be merged. As one said, "it would be just as feasible to arrange such a deal with any semiconductor company."

Liveware Saga by Don



## Memorex stock 'bombed'

"If the stock market looked like a battlefield yesterday, then what happened to Memorex stock has to be called saturation bombing."

In these graphic terms, the Wall Street Journal reported New York's reaction to worse than expected profit figures from the diversified computer peripherals company. The shares fell as much as \$11, that is 23%, before closing \$10 off at \$100 following announcement of third quarter profits up only \$100,000 at \$15.8 million on turnover up 33% at \$152.0 million, compared with the third quarter of 1977.

Memorex financial vice-president Henry Montgomery described the slide in the share price as over-reaction and pointed out that the company's fourth quarter was traditionally its best.

## End of Century

To keep pace with higher demand, UDH Automation, the Edgware-based computer bureau, has brought out an NCR Criterion V-8570 system to replace an NCR Century 300.

## Users' needs must be DPMs' priority

DEALING with users successfully depends on organised, systematic communication with them, according to Nigel Laurie, consultant and expert on IBM. Too often the data processing manager overlooked the need to involve the user departments in his organisation with the analysis of their needs and the plans to solve them, Laurie said.

Laurie was presenting, for the second time, a workshop on Successful User Relations, sponsored jointly by Computer Weekly and the Institute of Data Processing Management. Nearly 40 DPMs from a wide range of commercial organisations and government bodies gathered at the Holiday Inn, Marble Arch to take part in the day-long workshop which consisted partly of lectures by Laurie and partly of group discussions of users' needs and hypothetical case studies.

Clearcut strategies for DP management are particularly hard to establish now, Laurie said, because of developments such as convergence of computing and communications; divergence of usage, giving

users more control; and increasing concern in society that "the bottom line is not enough" — that the needs of customers, employees, and society at large must be considered.

The notion, however, that minis and micros are "democratising" information in the same way as printing did is misleading, according to Laurie. Printing led to standardisation, whereas the spread of minis and micros, each with a different architecture, is decreasing standardisation, presenting a major management problem.

Among the communications channels available, Laurie pointed out the establishment of task forces involving both users and DP staff as particularly useful. Although they are ostensibly meant just to get a particular job done, they also teach people about problems, and are a common experience.

Other useful channels are: induction courses, newsletters, hot lines, audio-visual presentations, and enquiry desks. There is a danger, however, Laurie pointed out, of becoming preoccupied with the media rather than the objectives.

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IAL numbers among its data communication clients the larger proportion of British clearing banks, several international banks, and numerous major commercial organisations in the UK, Europe and throughout the world. With bases in 50 countries and subsidiaries and associates in 10 more, IAL is particularly qualified to provide an international service.

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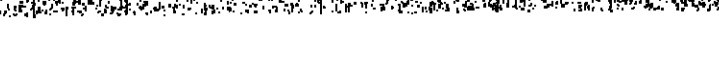
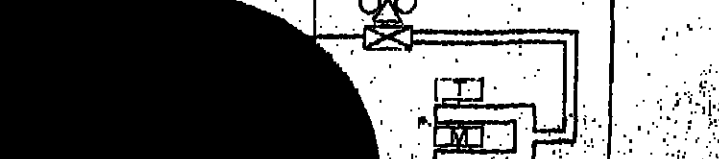
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## THE NEW TALLY T3000

The new Tally T3000 is the 300 lpm printer for high quality, high volume performance with mini computers, small business systems and remote terminal installations. It represents an evolution in the high reliability comb matrix printing technology first introduced by Tally with the T2000, of which 15,000 units have been installed throughout the world, consistently averaging over 1,500 hours MTBF. The T3000 guarantees:

- A true 300 lpm print speed irrespective of character set size.
- The ultimate in reliability from a mechanism which has only one major moving part combined with dual microprocessor-based electronics.
- Exceptional clarity of print and character alignment.
- Low long-term cost of ownership, which starts with a clear purchase price advantage over drum and band printers with the same performance and speed.

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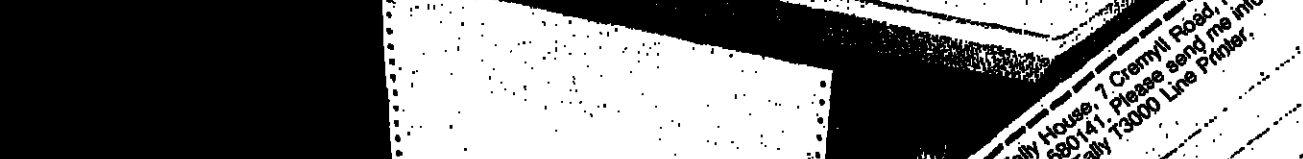
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## ICL film on how councils use computers

A FILM showing how local authorities use computers, not only in financial control but in managing housing and social services, has been produced by ICL. The commentator is TV journalist Trevor Philpott, and the aim of the film is to influence councillors and ratepayers who are still suspicious about computers.

The film makes the point that local authorities currently spend £15,000 million a year on an increasing variety of complex services, all of which require efficient information management.

Examples are shown of the use of computers in the allocation of council housing, matching up properties available with

families on the waiting list, taking account of number of children, special needs, and so on. The machine calculates the number of "points" each family has, to determine their entitlement.

Graham Goodhead, housing director for Manchester, appears in the film, and in extolling the value of the computer he asserts, "The shortage in housing has not been money or land, but good information."

In Leeds, social workers' case histories are held on computers, as the film shows, providing automatic reminders of the need for follow-ups.

Finding suitable foster parents for abandoned children is one of the tasks of social service department machines in Guteshead. All of these applications require careful confidential controls.

The fast-spreading teaching of computing in schools is also touched on. The film, entitled "The Computer in Its Place," was made with the co-operation of LAM. SAC and is available for hire from ICL for a nominal charge.

● A teacher and schoolchildren are pictured using a terminal, while at work behind the camera are film director Julian Aston and cameraman Ivan Strasburg.

## Swift interface facilities for City accepting houses

INTERFACE facilities to the Swift international banking network are being offered to accepting houses in the City by Ariel, the computer based stock dealing service, as a means of expanding and diversifying Ariel's business, which at the

moment is profitable but sluggish. The Swift interface service is being promoted by Ariel's new managing director, Garry Arnott (CW, October 18), who told Computer Weekly that it would be run on Ariel's Digital

Equipment PDP-11/40 systems which are under-used at present. Arnott said that the PDP-11s would run Ariel's Swift interface software and that modifications costing no more than about £2,000 would be needed to enable the system to service multiple users.

Arnott pointed out that 17 accepting houses already use Ariel for stock dealing, and that several of them were interested in forming a syndicate to use the proposed Swift service because in addition to their stock business they had very active currency dealings involving typically between 250 and 500 telex messages a day.

Arnott also hopes to boost Ariel's existing stock dealing business in several ways.

In the short term he intends to modify the Ariel stock dealing procedures so that users can consummate their deals over the telephone instead of solely via

display terminals. He believes that the lack of personal and congenial contact between Ariel users has been one of the main reasons that the service has not been as great a success as was once expected.

At the same time, he recognises the danger of Ariel losing commission through clients bypassing the computer system by settling over the telephone.

In the longer term Arnott hopes to encourage Ariel's institutional clients to develop stock jobbing operations using the system.

For the last nine years Arnott has been a consultant at the accepting house, N. M. Rothschild, an existing Ariel user, where his work has included developing financial models using computers. He plans to develop a model of how And works using the comprehensive records of Ariel transactions accumulated since the system first went live.

## Selling telecoms in the Third World

SELLING telecommunications equipment and expertise in the Third World is extremely difficult, and the handful of billion dollar contracts are hard-won.

Some guidelines and warnings were given at a seminar sponsored by the US Embassy in London last week, in talks by specialists in Africa, the Middle East and Latin America.

The problem in Africa is that the benefits of improved telecommunications are much less perceptible than those from better roads, more education and a higher standard of medical care.

Thus, for example, in Nigeria with 82,000 telephones for a population around the 70 million mark, anyone who wants to make a business contact tries to drive to his destination. But traffic congestion is so bad in Lagos that only cars with even numbered plates are allowed on the road one day, only odd numbers the next.

Rexford Owusu, Ghanaian journalist, who writes about telecommunications for Africa magazine, used the example of Lagos to underline the desperate need for better telecommunications in Africa.

Craig Blackman, now publisher of Telecommunications, who has experience of selling telecommunications equipment in Africa for Harris Corp, advised that anyone trying to solve the problems needed exceptional patience, and underlined the need for extended training programmes by companies selling equipment.

A country-by-country analysis for Harris indicated that business could be done in Kenya, the Ivory Coast and

Cameroon, and that Nigeria, Libya, Tanzania, Egypt, Senegal, Gabon and the Sudan were all promising.

Telecommunications in the Persian Gulf states are now extremely sophisticated, and business acumen has rapidly been acquired after the rip-offs of the first two years of the oil boom. That, anyway, is the view of John Whelan, telecommunications correspondent for Middle East Economic Digest.

Whelan's advice to potential salesmen is to keep a close watch on the movement of personnel within the government; if you do not talk to the man who has ultimate responsibility you are probably wasting your time.

Dr Tom Will, correspondent on Telecommunications magazine suggested five vital factors for success in Latin America.

A company needs to sign up outstanding local representatives, must make a long-term commitment to the country, should acquire "superb" marketing intelligence on changes in government personnel, recognise that financial packaging of the deal was often more important than the latest technology, and that labour-intensive equipment may still be relevant.

The seminar was staged to promote the big Intelcom '78 telecommunications conference and exhibition, which will be held in Dallas next February 28 to March 2. Further details of Intelcom '78 are available from: Horizon House, 28 Victoria Street, London SW1H 0EX. Tel: 01-223 1166.

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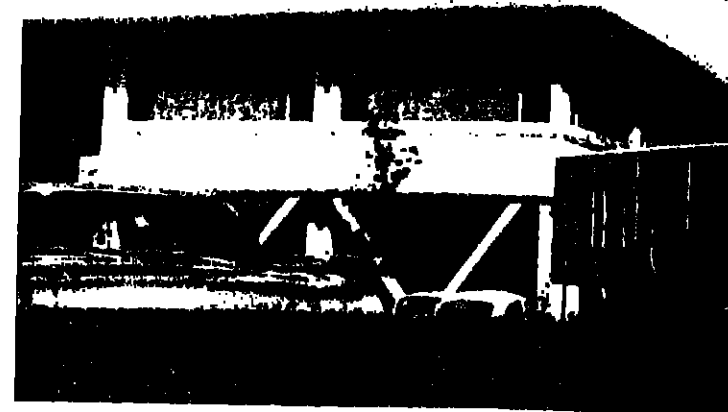
MICRO NEWS—1

With sales of about \$400 million as the target for 1979, Intel continues to be a force to be reckoned with in the microprocessor business. On a recent visit to two of the company's facilities in Santa Clara, California, Micro News editor Martin Banks discovered that Intel

has some different views on the future development of the microprocessor business from those of other companies in the field.

For example, there is little interest in the recent rise in popularity of Pascal as a high level language for

the 8086, 16-bit processor. Unlike others, Intel will not be supporting it. Also, though some companies suggest that the new 16-bit micro will bite deeply into the existing 8-bit microcomputer market, Intel seems content that this will not happen.



Santa Clara 4, home of Intel's design, development and marketing effort for microcomputers and microprocessors. From here comes the development work on the 8048 family of single chip devices which, according to the company, will be superseded in the controller market by the new generation of 16-bit microprocessors.

# Intel pursues its own line in the Santa Clara valley

THOUGH the corporate address for Intel is given as Bowers Avenue, Santa Clara, the company is now spread all over the Santa Clara valley in California, and one of the latest additions to the company's roster of facilities in the area, referred to as Santa Clara 6, is now the home of the Intel software development effort.

Recently leased from Fairchild, where it was used as that company's base for its now defunct digital watch operation, Santa Clara 6 is where Mike Kane, software product manager for Intel, has been working on the software to make the 8086 a living part.

This 16-bit microprocessor, which the company claims has a processing power equivalent to a Digital Equipment PDP-11/34 minicomputer, has been waiting since its introduction early this year for a new version of Intel's PL/M high level programming language, and now Kane has some of it ready.

Known as PL/M 86, it is a derivation of the original PL/M software written for the 8080 processor that has been extended to take advantage of the increased instruction set of the new processor. Its development will probably represent a high point in Intel's software development for some time, for though the company has recently introduced an ANSI-standard Fortran compiler to run on the 8-bit 8080, it is not really interested in other applications-oriented languages.

For example, Kane said that Intel had no plans to introduce a Cobol compiler, and although he thought Pascal a well-structured language that had things going for it, even suggesting its growing popularity made it "a people's language", no plans exist to produce this language for the 8086 either. He did suggest that its future could develop with 16-bit devices, but said that software such as Pascal was not Intel's market.

His task, he said, was to provide tools for the development of microcomputer systems.

While still compatible with the PL/M written for the 8080/8085 processor, PL/M 86 offers several new capabilities, especially the range of supporting utilities that are available. One, for example, is the Quick Relocation Load facility, which is a combined code providing a linking loader. This takes care of

segment ordering and segment loading, thereby minimising the number of disc accesses required.

Another is LIB-86, a collection of relocatable object packages based on the earlier LIB-80, while a third is a PROM programming package.

Further additions, according to Kane, are currently in the pipeline awaiting announcement. These will probably include an Assembler package for the 8086, together with a preliminary Assembler package.

Though Kane states that the company is not interested in applications oriented languages, it has already produced one, the ANSI-standard Fortran 77, and there are indications that another, Basic, is about to be launched.

The Fortran compiler, which was introduced in March, meets the latest ANSI sub-set

standard, with the main exceptions of double precision arithmetic and complex data types. According to Kane it has been introduced by Intel because it is still a good development language, despite its applications programming orientation. Full run time support under the real RMX time executive is soon to be available for this.

The rumoured Basic interpreter is believed to be scheduled for launch some time this month, although Kane was not willing to comment on this. The suggestion is that it will be a 32K byte extended Basic package, designed to meet the ANSI standard for Minimal Basic.

This, in common with the other software offerings from Intel, will implement the new Intel Maths Standard. This is a set of maths algorithms that have been developed by the company. The hardware is a

single board system known as the 3/10, a 32-bit, memory-mapped board that uses mainly bipolar logic and firmware program memory. It is used to run single precision floating point maths, and according to Kane, when coupled to an Intel development system running Fortran 77, becomes a very strong tool.

For example, it greatly increases the added value of the development system by allowing users to run many of the general engineering packages that are widely available in Fortran.

Intel as a whole is doing very nicely, having turned in sales of over \$280 million in 1977, and planning for sales of the order of \$400 million by the end of 1979. A growing slice of this business is now coming from Europe, which is generating an annual 25% growth in Intel's sales volume.

One of the lead products in this growth is the 8048 single chip microcomputer.

The original device in a growing family of single chip products, the 8048 has a strong long-term future in the Intel scheme of things. Unlike Motorola, which has suggested that the coming ranges of 16-bit microprocessors, coupled with high level languages could eventually bite deeply into the current market for 8-bit devices like the 8048 (CW October 12), Jeffrey Miller, product manager for the microcomputer family, feels that the development capability of the 8-bit devices will continue to give them the

Turn to page 15

MICRO NEWS—2

## Inmos stress on single-chip

FURTHER evidence has come to light indicating that the NEB's fledgling semiconductor company, Inmos, is looking hard at single-chip microcomputers for its future product base, rather than the famed 64K RAM.

In an article entitled "The future of the microprocessor—a personal view," in the June edition of the quarterly Microelectronics Journal, Iann Barron, the UK's one-third of the Inmos triumvirate, writes at length on the way he sees the microprocessor developing.

He sees two potential, non-exclusive ways in which the micro may develop. One leads, through technology improvements, to micros containing far greater processing power. This might include the use of mainframe computer architectures such as the IBM 370.

The other way, about which he writes at some

length, shows the increased storage capabilities of single chip microcomputers as being of great importance—a route currently pursued by Intel (see feature on facing page).

Unlike Intel, however, he feels that the inclusion of on-board peripherals such as A to D conversion will increase the application dependence of the devices. This will lose the concept of the "universal" microcomputer.

The addition of further peripheral functions may, he suggests, reduce rather than extend the market potential of microcomputers. A way round this which Barron points to is a possible move to "custom" processors, where the customer can specify the configuration of standard architectures, store and I/O functions.

Is this, perhaps, what Inmos is planning?



BARRON... possible move to "custom" processors.

## Talks on third 'arm' for French strategy

A THIRD possible "arm" for the French microelectronics strategy has emerged following talks between Matra of France and Harris Semiconductors of Melbourne, Florida.

The talks are about Harris' Self-aligned Junction-isolated CMOS technology, and envisage Matra setting up a new company in which Harris might take a small minority stake. Money would come from the French government for establishing a CMOS plant.

Self-aligned Junction-isolated technology is said to enable propagation times of 5 nanoseconds per gate to be achieved,

and allows a gate density of 175 per square millimetre. It is particularly appropriate to military applications, a field where Matra is strongly represented, since it operates in the -55° to +125°C temperature range. Operating on a five volt power supply, circuits can function at up to 40MHz.

Matra already has a joint-venture company with another US partner, TRW. The company, Matra Informatique, is 45% owned by TRW, and markets Datapoint equipment, TRW point-of-sale and banking terminals, and GCS key-to-disc systems in France.

# Growing impact of the micro in DP

INTEREST, both personal and professional, tinged perhaps with a touch of fear brought out the DP people last week to attend the Institute of Data Processing Management's session on the impact and relevance of the microcomputer in data processing.

They came to hear a series of presentations from protagonists of both the microcomputer and mainframe, and to take the opportunity of some hands-on experience on six different microcomputer systems brought especially for the occasion.

The panel consisted of Robin Woods, a consultant and director of Isler-Woods, a personal computer shop that opened recently in Luton; Paul O'Grady of Micro Focus; Myles Pollock of Templeman Software Services; Conway Berners-Lee of ICL; and Dr Adrian Stokes of Langton Information Services.

In the chair for the session

was Computer Weekly editor, Malcolm Peltu.

There was broad agreement between the panellists that the micro would have a growing impact on the activities of the DP department and its manager, though opinions varied as to how and where this might first become apparent.

O'Grady, the first speaker, pointed to the fact that the primary interest of DP people was in making effective use of their skills, which by and large revolved around programming in Cobol. With the introduction of software like his own company's CIS Cobol for running on micros, there was now the opportunity for DP people to work directly with micros in their own environment.

In addition, the combination of an Ansi standard Cobol with CP/M, an increasingly popular operating system for microcomputers, now meant that a high degree of software portability

could be achieved, which in a business environment could have great significance to the DP department.

Support for O'Grady's view came from Woods, who said that there was now a tremendous opportunity opening for the DP department. This was not without its responsibilities, he said, especially in overseeing the use and implementation of such equipment.

In response to questions on maintenance, he said that it was not too bad. In one respect some manufacturers were almost second sourcing, like the semiconductor industry, with plenty of alternate manufacturers of sub-systems and components around. In another respect, even the cost of buying a complete spare system, say £3,000, could be viable if this meant downtime was kept to about one or two hours. "Not even IBM can always achieve that," he said.

From the mainframe manufacturers' point of view Berners-Lee could see a big role for microcomputers, but mainly in a subservient role.

He pointed to the submission to the American FCC by Bell that, if approved, would take the public carrier much nearer to the user, with Bell handling all protocols. At the user level, much of the hardware would be micro-based, he suggested, but he saw such hardware generating vast amounts of transaction traffic.

## Systems show in Sweden

NEXT in a growing round of European exhibitions and conferences on microcomputer systems is to be held in Sweden, at the end of November.

The Microcomputer Systems show is to be held at the Svenska Mässa Stiftelsen in Gothenburg, between November 28 and December 2, and an impressive line-up of exhibitors have already booked space at the show.

These include Zilog, Compucorp, Trivector Systems, Texas Instruments, Motorola, Altair and Rai.

Further information can be obtained by writing to Box 8222, S-402 24, Gothenburg, Sweden.

## Intel pursues its own line

From page 14

edge in the low-cost controller marketplace.

Miller, based at Intel's Santa Clara 4 facility, points to several areas where developments in the capabilities of the product would continue to give the necessary advantage. His suggested scenario of developments starts with a continuing expansion in the amount of program memory included on the chip, followed by an expansion of the data memory capability.

But the area that will probably get the most attention in the future, Miller suggests, is that of I/O capability. In particular, he sees increasing attention on providing much higher voltage directly from the chip.

Such a move would obviously be aimed at reducing the number of peripheral circuits that are currently required to produce system hardware for even small controller applications, with the eventual objective being the production of the true single chip system.

To some extent, this philosophy has already been put into

effect with the 8022, a member of the 8048 device family. A derivation of the 8021 part, the lowest cost/least performance variant which is already a \$3 part when bought in volume, the 8022 already incorporates several of these points. The program memory has been doubled, to 2K bytes, and the interfacing has been designed to be flexible enough to cope with odd voltage ranges, such as those found with touch panel keyboards (thus allowing direct data entry). Perhaps its most significant capability is the inclusion of an on-board analogue to digital converter. This, according to Miller, can reduce the parts count in customer systems by ratios of between 7:1 and 20:1.

Following the cross-licensing agreement with RCA, through which RCA gained the right to produce 8048 parts in its CMOS process, Intel is itself looking closely at the market for low power devices, which the RCA part would be. In return for the design rights to the 8048, RCA has provided Intel with technical information on CMOS processing, and according to Miller, Intel is finding that the potential market for CMOS 8048s is be-

ginning to look attractive. No final decisions on whether to make a move into this market have yet been taken, however.

# CORAL

Coral News appears every quarter to provide users with up-to-date information, news and opinions. Items for inclusion should be sent to the Coral Press Co-ordinator The National Computing Centre, Oxford Road, Manchester M1 7ED.

## Standardisation

BSI's Working Group concerned with programming languages for industrial use are issuing the draft British Standard at the end of October. The draft incorporates the original official definition which became known as the blue book and will be submitted to ISO as the first stage in Coral 66 becoming a standard international programming language.

## CORAL Availability

New Coral 66 compilers have been announced by HPAC for Perkin Elmer (Intersect) S-32 and Data General Nova. Compilers are available or under development on machines from the following manufacturers' ranges: CIT, Computer Automation, Control Data, Data General, DEC, Ferranti, GEC, Honeywell, IBM, ICL, Intel, Kongsberg, Modcomp, Motorola, Nord, Norden, Perkin Elmer, Plessey, Prime, Rank Xerox, SEL, Smiths Industries, Sperry Univac, Texas Instruments.

Official MOD approval has been granted to Modcomp for their compilers for Modcomp II and IV. For up to date detailed information on Coral 66 compiler availability ring Malvern (06845) 2733 ext. 2165.

## Books

NCC received "a small round of applause" from Computer Report for publishing Coral 66 Programming. CR said that the book by John Webb offers solid information about the concepts and facilities of the language and deals in considerable depth with the practice of Coral Programming. The book is £5 and at the same price is NCC's A Course in Coral 66.

## Training

Courses in Coral 66 are regularly offered by several organisations including CEB, Ferranti, GEC, NCC and SDL. NCC's Real Time Program Design Course was developed for the Coral 66 Group and runs for 2 weeks starting 23 October, 19 February and 4 June.

## MASCOT

MASCOT—Modular Approach to System Construction, Operation and Test—is an integrated approach to design, implementation and testing of real-time parallel processing software based on a form of modular decomposition.

Development is being controlled by a joint industry—MOD group with major work packages being undertaken by software houses including CAP, Software Sciences Limited, and Systems Designers Limited. Commercial products using MASCOT are being developed. 7-day workshops on MASCOT are being run by Intotech starting 24 October and 30 November.

## A CORAL case study

CORAL 66 helps to control half of Bavaria's electrical power. The language is used for the operating software and all the programs used in the computer system of the Central Control Room at the Bayernwerk Electrical Power Authority in Munich, West Germany.

Bayernwerk generates 3500 MW from nuclear, coal, oil and hydro electric power stations and the British firm of Ferranti were chosen to supply the control computer as well as the visual display equipment and the standard software.

Bayernwerk's new control centre schedules the generating stations and supervises the fuel and frequency including exchanges with local networks. The control room has two operating desks. One desk is for load dispatch and a 380/220 KV network and the second for a 110 KV network. Each desk has three CRT displays on which symbols and lines represent items, their states and voltage levels. A diagram of a station shows its active and inactive power as well as the voltage and current alongside each named circuit.

Overall views on the screens show the entire network with colour representing the voltage of interconnecting lines. Greater detail can be examined by stepped magnification up to single stations. Where a station diagram is too large it can be rolled across the screen.

The security features of the system range from badge readers for the operators up to sophisticated on-line safety checks. The latter assess the outcome of an input command and inform the engineer of any critical conditions resulting from his instructions. The system collects accumulated meter readings for billing purposes and loading information. It can also cater for future modifications to the network.

The work is handled on a symmetrical dual computer system; each half having an ARGUS 700E with 32K words of store front ending an ARGUS 700S with 112K words and 12 megawords on moving and load head discs. The ARGUS 700 computers were designed with CORAL requirements in mind giving a particularly efficient implementation.

## CORAL Applications

The West Midlands Police have an operational system for which Coral 66 was used to write all the applications and systems software. The computerised command and control system controls on duty patrol cars, PMS processes.

Coral 66 has been used extensively on the development of Lockyer, new system for the Hotel Indefatigable. The system is based on the IBM 4380 with visual display unit, monitors printer and teletype. The system controls the kitchen, room service, laundry and control and is said to be suitable for beyond 100 beds.

Hampton and Bampton offer two new support packages which are the first of a series of Coral 66 VARIANTS for file handling and a performance which reformats and cross references. These and their earlier packages COSH (String handling) and COIN are all available for ILC equipment but they are prepared to translate them to other vendors. Bampton and Hampton can be reached at Cambridge 88172.

CEGB's new software system COMPASS will be written in Coral 66. COMPASS is intended as the future standard for all of the Board's real time on-line computing and will be available to outside equipment manufacturers.

By the end of the year the MOD should have a MASCOT Kernel for use on a Ferranti F100. This is the outcome of a contract placed with Yard for the real time executive which will be written in Coral 66. The kernel is intended particularly for memory resident applications and is likely to be initially used in a distributed control system for ship power plants.

The growing complexity of satellites has resulted in bottle-necks in the testing system used by European Space Technical Centre (ESTEC). The system consists of CTL computer interface via CAMAC to the measuring equipment. CTL have developed a new controller for the latter data rates and the programs were written in Coral 66.



CORAL 66 in Routine & Police Configurations.

Published by NCC, a label of the Royal Society of Industry, sponsored by CORAL 66 Group.

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## Scicon turns to universities

THE growing number of computer science courses offered at UK universities is having a significant effect on the recruitment policies of at least one major UK employer.

Scicon reports that it has largely ceased recruiting experienced staff, and instead combs the universities for com-

puter science graduates, citing Edinburgh and Loughborough as sources of high-class graduates.

"The people we are getting from the universities now are able to do useful work for us from the day they join," a Scicon spokesman told Computer Weekly.

## Specialist group for database users acts as a forum

THE Specialist Group for Database Users is one of the newest within the BCS. It was formed in March of this year and officially recognised by the society only in September. The group acts as a forum where users of database and teleprocessing software packages may get together to discuss common problems.

Until the formation of this group the only means users had of exchanging ideas and of discussing problems, was within the user associations of their particular software vendor, whereas problems associated with databases are often common to different systems.

Of particular interest to members of this group are aspects of data administration, the use of data dictionary systems as an aid in this work, and the various techniques available for data analysis.

The group meets six times a year, on Wednesday afternoons at University College, London, and the average attendance of about 45 is proof of the need for such a group. It is planned in 1979 to publish papers based on the presentations given by the speakers at the meetings.

Speakers for the coming session include Trevor Sankey, of the Institute of Oceanographical Sciences, who will

This is the second in a short series about the BCS Specialist Groups. Geoff Baker, of CACI International, outlines the activities of the Database Users' Group which is one of the latest to get BCS recognition. With other groups, the database people will be taking part in the BCS 79 Living with Computing conference and exhibition which is to be held in London from January 4 to 8 next year.

will be dedicated to the discussion of the various data analysis techniques which may be used by data administrators and there will be sessions on specialist database techniques and on data dictionary experience.

Further information about the group can be had from Geoff Baker, CACI Inc International, 789 High Holborn, London WC1V 7JZ. Tel: 01-405 8234.

At BCS 79 the group's first speaker will be Brian Davis, an independent consultant, who will be putting the database into perspective. He will discuss the state of the art and look at what is being achieved by the use of database software. He recognises the major problems of deciding at what stage the risks associated with a new technique become acceptable - adventure too soon, you may be pioneering, if you leave it too long you may miss substantial benefits.

I will be discussing "The Database Approach." Data is as valuable a resource as any of the other resources an organisation possesses. If an organisation loses its list of customers, the effect can be as catastrophic as a fire. It is essential that the organisation of the data be centrally controlled by a data administration function.

Finally, Mike Bibby of STC, and vice chairman of the BCS Data Dictionary Working Party, will describe "Living with a Database." He will review the first two years in the life of a large database containing all the manufacturing data of a company.

## Voice response system speeds Toyota orders

VOICE response terminal equipment from Menzies Communications Systems of Camberley will enable Toyota GB to save three hours on urgent orders and give dealers a check on their order entry.

The £80,000 system replaces an Ansafone and Seecheck system.

Dealers will send order information via a Periphonics keypad

acoustically coupled to a dial-up telephone line to the voice response system. The order is processed on Toyota's ICL 1900 computer and a recorded voice message is assembled and played back to the dealer confirming the details of his order, telling him if the item is out of stock.

Menzies recently switched to Periphonics systems, from Wavetek, because it said they were more flexible.

Both systems come from the US and Wavetek systems are now marketed in Europe by Racal-Milgo (CW, August 10).

## Rockwell splits into three

TO promote growth in its bubble memory products as well as other technology areas, Rockwell International is restructuring its Microelectronic Devices business into three sectors: bubble memory products, device products including MOS LSI and gallium arsenide devices, and telephony subsystem products including LSI modems.

## First of many

FIRST production configuration of the £300,000 Nord computer system for the General Dynamics F16 flight simulator has been completed and is about to be delivered. The first of an initial order for 18 systems, which consists of five processors

## Words of warning to systems architects

I WISH to reply to Tom Gilb's excellent question "Who is ready to put 'architect' on his calling card?" (CW, October 5), by pointing out that we already have done so for the past six years. Our company name, Software Architects, was in fact second choice because the Registrar of Company Names disallowed the "Systems Architects" or the "Systems Architect" on the grounds that it was more suitable for a construction company specialising in system-building (ie of high-rise flats).

In view of the demise of this technique after Ronan Point, perhaps it's just as well we didn't adopt that name after all!

In any event, the computer industry in the UK is by no means

wider talents: psychology (to motivate users); ergonomics (to design an acceptable man-machine interface); the intellect and inquisitiveness of a lawyer (to perceive root problems rather than symptoms), to name just a few. These are in addition to the normal computer expertise.

The situation is different in the US, since you have to be able to do more than merely write ledger program specs to call yourself a system analyst or systems engineer.

So, I would like to supplement Tom Gilb's question to his readers with my own: "Have you identified and queried every implicit assumption?" and are you sure the answers do not cause a bigger problem at an interface or elsewhere? If you can answer "Yes" to all these, then you'll be doing your users and yourself a big favour.

Only then should you put the words "Professional Systems Architect (Computer)" after your name!

TONY FRIEDLANDER,  
Manager, Systems Division,  
Software Architects Ltd,  
London.

## Intuition: Why IBM presumes too much

IBM has recently had a number of full-page advertisements in the national press, apparently designed to calm public disquiet about computers. In one of these they make the claim, "No computer will ever be able to take decisions based on intuition," and I am prompted to wonder what makes them so sure?

One can of course define intuition as a purely human attribute, but this begs the question, since we now have to ask, "Is it possible for a computer to take decisions which, if taken by a human being would indicate use of intuition?" and the answer to this must be "Why not?"

One dictionary definition of intuition is "immediate apprehension by the mind without reasoning," which sounds

very like a table look-up.

More seriously, the essence of intuition is surely the absence of conscious reasoning. When we use intuition we depend on our store of information about the world in general and the given situation in particular, and presumably there is an elaborate process of associative searching which leads to the final decision. Present technology of hardware and software may not be capable of this, but there is nothing fundamental about computers to stop them behaving like this.

If IBM wants to announce that none of its computers will ever take decisions based on intuition, that is its business. But I wish it wouldn't presume for the rest of us.

D. W. BARRON  
Southampton University.

## Low-cost version Gamma's Proteus

A LOW-COST version of Gamma Computer Products' top-of-the-line Proteus system has been introduced, offering users a complete disc-backed microcomputer system for £12,400.

The Proteus consists of a DEC LSI-11/2 microcomputer with 64K bytes of memory, 12-line, 40-character plasma display, 80 chips, and the new version comes with two DEC RK05 compatible 5 Megabyte cartridge disc units. The more expensive Poseidon, already available, has 15 Megabytes of fixed disc storage and costs just over £18,000.

The Poseidon is the top model in Gamma's Olympic range of LSI-11-based microcomputers, which are marketed in the UK under licence from General Robotics of Harford, Wisconsin.

The other models are the Triton, which offers double-sided double-density floppy disc storage, and the desktop Pro-

teus, which includes processor, plasma display, printer and three mini-floppy drives in a single unit.

Markets identified for the Olympic range include education and research, hospitals and large, multi-site commercial customers, particularly in retail and distribution trades.

Gamma has a wide range of system and application software available, including its own proprietary NET-11 real time timesharing operating system, with DIBOL and Basic support. Most of Gamma's application software is written in DIBOL, the proprietary DEC business language.

Gamma has achieved something of a coup with the installation of the first Proteus system in France. The customer is Info-Service SA of Orsay, which is using the Proteus for software development.

Gamma Computer Products, of Wokingham, Berkshire, is a member of the Nottingham-based Gamma Associates group.

## Dealing with other people...

A COURSE intended to help computer people deal better with others, both outside the DP department and within, is being run by BIS Applied Systems on October 31 to November 2. Called "Interpersonal Skills - Transactional Analysis," the course will use televised case studies, workshops, and role playing to help managers improve productivity through "an understanding of how people at work react to one another, their attitudes and motivations, especially as expressed in personal communications."

The two-and-a-half day course will be held in London and will cost £235, including overnight accommodation. Further details can be had from Jackie Collings on 01-633 0866.

## The portable terminal that remembers, even when it's switched off.

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## £250,000 saving on electricity bill

BIG enough users of electricity can afford to shop around for the cheapest rates offered by Britain's 15 area electricity boards. The only problem is that as the rates and relationships are constantly changing, it is difficult to keep pace.

As a result, the Post Office has solved the problem with a suite of computer programs developed at the Post Office Data Processing Service. A year's trial in the Midlands Telecommunications Region showed a saving of £30,000, and now the system is to be extended to cover all 9,000 telecommunications buildings.

The Post Office Data Processing Service is presently equipped with four Leo 326 computers, a 2870 and a System 4/72, all from ICL.

## Netcom to give DoE flexible access to 1900s

MORE than 70 teletype and batch terminals in Department of the Environment offices in the South of England will be able to access any of three ICL 1900 series computers at its Hastings computer centre through a Netcom communications processor from Systems Reliability, the Luton-based maintenance and engineering firm.

The Netcom is a protocol transparent device which will accept signals from terminals in London via a Racal time division multiplexer at DoE Marsham Street headquarters and separately from batch terminals in Bristol, Croydon and Hemel Hempstead, where activities include collecting construction industry and road accident statistics to be stored and processed at Hastings.

The Netcom routes the data from up to 60 incoming lines via a patch matrix to a pair of ICL 7930 line scanners which feed a 7903 processor front-ending a 1906A mainframe, as well as another 7903 and a Digico M16 which front-end two 1904S mainframes.

It functions as a contention unit, giving back a "busy" message, or it can store and forward messages when a calling terminal cannot be connected to a mainframe.

The £70,000 contract includes the Netcom, the multiplexer, modems and the patch matrix and the DoE expects the equipment will save about £40,000 a year, largely on Post Office costs.

## Data link delay continues

A DATA link delayed by the Post Office Engineering Union's industrial action (CW, July 20), which ended in August, is still held up. The link is over a leased line from London University Computer Centre to University College to enable the centre to talk to Cambridge and Newcastle University computers through a protocol conversion facility at University College. ULCC cannot use a dial-up line because University College only has one dial-up connection and so cannot link to ULCC and Cambridge at the same time.

The new line was installed during the POEU action, but has not been connected because paperwork was not completed at the time, according to Neil Williams of ULCC Service Development Department. The Post Office is unable to give a date for connection.

## £1½m Prime order

ITS biggest yet order outside the US has been received by mini-maker Prime for a dual model 500 system to provide interactive computing for Wolverhampton Polytechnic. This £500,000 system will replace an ICL 1903, and thus the Poly is joining the swing away from mainframes towards minis at educational establishments (CW, March 23).

Wolverhampton Poly's computer courses are expanding rapidly and its present split of 70% batch work, 30% online is expected to reverse when the Prime system, capable of supporting 64 terminals to start with, has become established.

Later, up to 96 terminals will be usable at once.

Each of the interlinked 500s will have 1.5 Megabytes of memory and 600 Megabytes of disc. The interlinking will mean that users connected to one processor will be able to access files on the other's disc with no difficulty. The whole will run under Prime's own Prime 3 virtual memory operating system.

Most of the terminals used will be ordinary VDUs, but some will be graphics terminals. In addition to student users, administrative and library staff will be using the system.

## Database power

### From front page

offered include a data dictionary and a librarian.

Conversion facilities for upgrading from System 3 are offered, and System 38 can be used as an SNA terminal to a 370 mainframe.

Two processors are offered, cycling at 1,100 or 600 nanoseconds, and main memory expands from 512K to 1.5 Megabytes. The smaller model uses 64K bit memory chips and the larger 32K bit chips.

CPU, disc, floppy disc magazine and the operator console are integrated into a single unit, and the Model 3 is field upgradable to a Model 5.

Software is available on a monthly rental. A system with four displays, two terminal matrix printers and the basic system line printer, 512K system and two discs, costs £63,000. With 40 terminals, 1.5 Megabytes and disc it would cost £230,000. Deliveries begin in the last quarter of 1979.

## Amdahl upgrade

### From front page

making the V/8 marginally cheaper than IBM's 3033.

The V/8 is substantially more powerful than the IBM 3033. Amdahl rates the V/8 at 1.2 to 1.3 times as fast as the V/7 when running interactive, high supervisor state workload like airline reservations. Against the IBM 370/168-3, Amdahl rates the V/8 at 2.75 to 2.95 times faster, and taking a 3033 as 1.8 times a 168-3, this suggests that the V/8 is 1.53 to 1.64 times a uniprocessor 3033 and probably equivalent to a multiprocessor 3033 — which is double the price of the single processor version.

Deliveries of the V/8 begin next September, and field upgrades of V/7s will take one day or less and cost £160,000.

The new 478V/15-11 model, available in January, doubles the buffer capacity to 32K bytes, giving 10% better performance

than the existing model. The V/8 and V/8 models have all been reduced in size by the use of more compact 4K-bit memory chip boards.

Amdahl has also announced another record year of turnover and profits. Net profit for the 1978 third quarter was up 100% at \$12.8 million compared with the same quarter in 1977.

### VME/B switch

THE Central Electronics Generating Board is to equip its VME/B work to partly-owned 2870 from the existing VME/B 2800. The machine is being converted to a DME facility to enable it to compete already has a DME machine which is running the workload of the

## RELATIONAL DATABASES

### By Max Stewart

In this, the first of a 10-part tutorial series on databases and structured file design, Max Stewart sets out to show that these techniques are not obscure state-of-the-art

theories but methods that down-to-earth systems designers should be using. Stewart, who is divisional technical support manager for Leyland Vehicles, the

commercial vehicle division of BL, shows there is no need for the mathematical jargon and abstruse notation often used by some proponents of relational databases.

### Part 1

THE object of this series is to introduce relational database principles which can be applied in practice both to conventional file design and to database design while avoiding the theoretical complexities which are the purists' delight. The exposition is a personal one; and — in the interests of getting the message across — liberties have been taken with established nomenclature.

File and database design only is covered; relational data manipulation languages form a separate topic and one over which the systems designer (as opposed to the database management system designer) has little control. Given sufficient interest this may form the topic of a future series.

Basic ideas. If you are a systems designer, you probably use relational database concepts unknowingly. For example, Des, our enterprising systems designer, has six data items with which he must construct one or more files:

CAR-REGISTRATION NUMBER  
CAR-COLOUR  
YEAR-OF-REGISTRATION

He automatically groups them thus:

File 1 (car file)      File 2 (personnel file)

CAR-REGISTRATION NUMBER\*  
CAR-COLOUR  
YEAR-OF-REGISTRATION

where the key fields for each file are asterisked. Why does Des group them in this way? Because he feels instinctively that:

- Each key field should represent an object, and that a value of a key field should uniquely define a particular object (eg XYZ123 represents one and only record in the car file).
- Each field which is not a key represents some attribute of the key (eg SEX is an attribute of an employee who is uniquely identified by EMPLOYEE-NUMBER).
- The clustering of a key field and associated attribute fields in each of the files is inherently stable: Cars may sprout wings, for example, and WING-SIZE may be added to the car file; a new Equal Opportunities law may cause SEX to be removed from the employee file; but the likelihood of ever having to move CAR COLOUR from the car file to the employee file is rather remote.

Putting intuition on paper. Des's intuition has taken him a long way. The other members of his team do things in more or less the same manner but sometimes come to blows over the repercussions of enhancing existing systems.

Des is adamant: "If you'd designed it my way you wouldn't have been forced to move so many fields from one file to another." The retort is always: "We've heard it all before; what exactly is your way?"

And this is where Des starts to waffle. He knows that his design technique is basically sound but he is at a loss to explain precisely what he does and why.

Relational design principles. The principles Des uses can be derived from a concise and generally straightforward technique which we shall call relational design. Because data items are clustered into files using rules which refer only to the meanings of the data items concerned and the relationships between data items, the resulting file structure is independent of any file handling package, database management system or computer manufacturer.

This file structure may subsequently be modified to suit its intended applications, but the modifications tend to be easy to implement because the initial logical file structure is simple to understand.

Two characteristics of files constructed on relational principles ("fourth normal form" files) are:

- Each file has a linear structure (i.e. no repeating groups)
- Non-key fields in a file are attributes only of the file key and not of each other.

The ways in which relational files can be created are best illustrated by example. This example will be referred to frequently in subsequent articles, and readers are advised to keep it for reference.

Example. A conventional (but badly designed) file is shown in Figure 1.

A warehouse stocks many items and each item is uniquely identified by the value of ITEM. Each item is described by a DESCRIPTION, and it is possible for several items to have identical descriptions. QTY-IN-STOCK is the quantity of each item currently in stock. A customer is uniquely identified by the value of CUSTOMER, and he places all his orders through one SALESMAN.

## Texas adds a DBMS on 990 CMG packages aid group

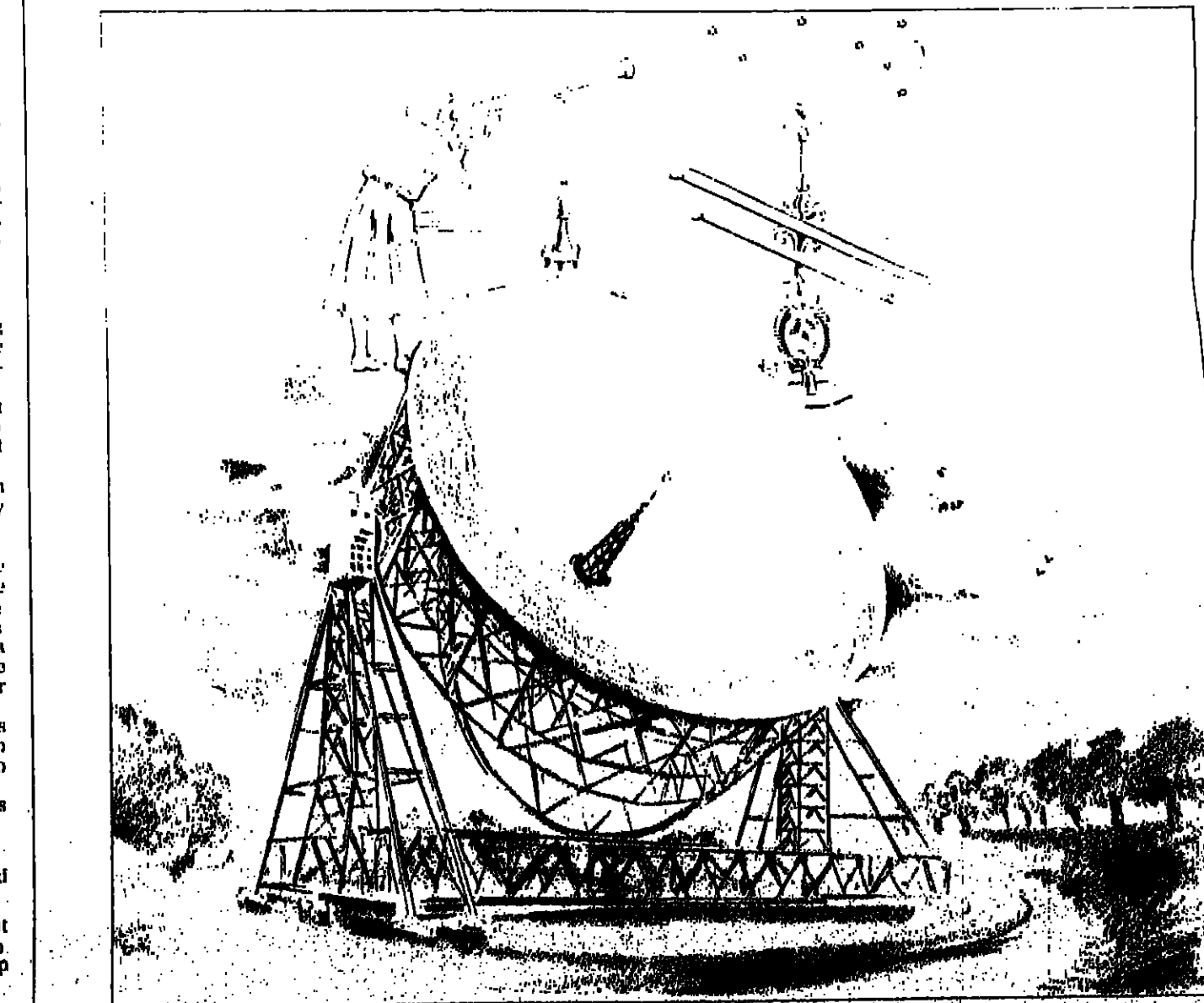
EXPANDING its offerings for the OEM systems builder, Texas Instruments has added a proprietary database management system on its DS990 line of packaged TI 990 minicomputers.

The system, called DBMS 990, was written in Pascal, and is described as being similar to Cincom's Total system. An RPG II similar to that on the IBM System 3, Cobol, Fortran IV and Pascal are also available.

INTERNATIONAL construction group French Kier Holdings is now using a computer service provided by Computer Management Group (Middlesex) to handle the administration of its pension scheme and payroll. Based on the CMG Payroll package, the company's pension scheme is expected to reduce the complexity and time taken to process pension claims.

ITEM DESCRIPTION	QTY IN STOCK	ORDER NO	CUSTOMER	SALESMAN	QTY
Keg Steel	300	1 2 3	Groby Spuman Everaoff	Joe Jack Jack	12 20 6
Bung Steel	10,000	4 5	Crudington Fuddle	Jack Jim	1000 500
Tap Brass	300	2 4 6 7	Spuman Crudington Spuman Groby	Jack Jack Jack Joe	20 10 30 60

Figure 1



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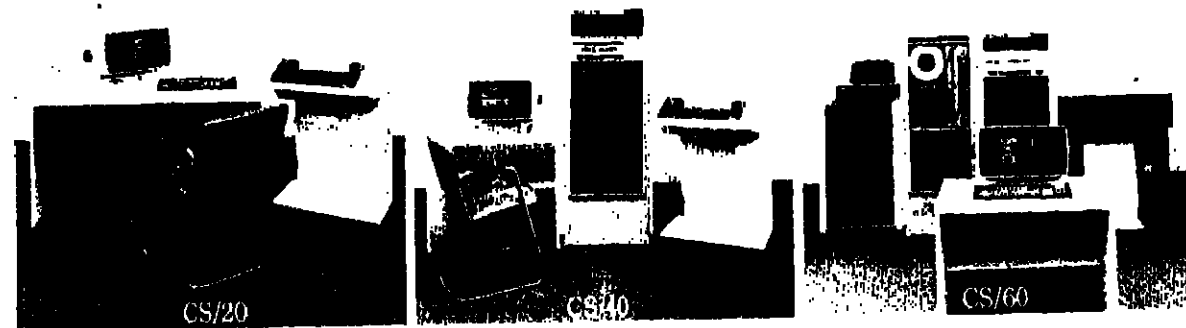
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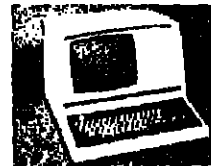
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MM11F 256K core stack (11-30, 11-35)  
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MM11F 1024K core stack (11-40, 11-45)  
MM11F 2048K core stack (11-45, 11-50)  
MM11F 4096K core stack (11-50, 11-55)  
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# Key questions on AT&T's Advanced Communications service that remain unanswered

In the past 18 months, the US communications community has been abuzz with speculation over what Ma Bell has planned with her new data-oriented transmission service. Now that initial details of AT&T's Advanced Communications Service have been released, some of the speculation has ceased. However, key questions concerning tariffs and service support, for instance, remain unanswered.

What is more, the AT&T document outlining its plans for the service has raised another matter the suspicious and quizzical to puzzle over; namely, should AT&T announce a service that seemingly copies what is already available from other carriers today, or is the service may not be available until 1983?

It is that AT&T is considering its policy of duplicating competitive equipment and service that catch on with users? At policy was evident in the late 1970s when Datran announced its plans for a digital transmission service. In response, AT&T did a speedy and complete turnaround from a position of no interest in the market to pushing through, double-quick time, its phone Digital Service.

Competition was not a facsimile of its own service, and with what it claimed predatory pricing by AT&T, it subsequently went bankrupt.

Otherwise, it was the independent Bell firm which planned modern developments as 9,600-bps units, diagnostic aids and devices capable of operating full duplex at 1,200 word dial-up lines. Now Bell has all these capabilities.

AT&T's Advanced Communications Service addresses the compatibility problem by providing code conversion, protocol translation and speed matching so that diverse terminals and computers can communicate freely, and a single

headquarters in Basking Ridge, New Jersey, is that the old mode of reacting to market developments has given way to a new market-driven organisation that anticipates customer needs and satisfies them.

Before introducing ACS, AT&T claims to have embarked on a major project to gain "a better understanding of the composition and size of the overall data communications environment."

To do this, AT&T says it studied over 2,000 users of data communications from all economic sectors of industry, education and government, and conducted "in-depth interviews with decision-making personnel of some 65 major data communications users in 23 industry segments."

What AT&T found was that users face four types of problems in implementing and operating their data communications systems:

1. Users have tended to develop a separate network for each purpose or application, resulting in incompatible and under-utilised networks;

2. Users often have difficulty in modifying existing networks to accommodate changing requirements;

3. Users are finding that the task of managing multiple networks, including the monitoring of their performance, is becoming an expensive and time-consuming burden; and

4. Data communications systems often have start-up costs that are too high to justify their use by smaller users or their deployment by larger users for applications that do not support substantial expenditures.

AT&T's Advanced Communications Service addresses the compatibility problem by providing code conversion, protocol translation and speed matching so that diverse terminals and computers can communicate freely, and a single

terminal can access multiple applications over a shared network.

Flexibility is achieved by offering users a broad set of data communications capabilities from which to select standard features. Users may also define customised features depending on their application needs. In this way, ACS is meant to assure users that their data communications investment will remain usable in the face of rapid expansion and changing technology.

At the best of times, the FCC availability is clouded by regulatory, legislative and even judicial considerations; so no one knows for sure when, or even if, the service will become operational.

AT&T's schedule calls for tariffs to be filed by mid-1979 and for three nodes to be in place by year end, growing to 100 nodes by the mid-1980s. In view of the opposition ACS faces at the Federal Communications Commission, that schedule is glaringly optimistic.

It all sounds so much like motherhood and apple pie that one is tempted to wonder if there is a worm in the apple. In fact, there may be several.

ACS attacks the third problem area, network management, by providing users with information on the status, usage and performance of their particular "subnetworks." Finally low entry threshold is achieved by allowing a gradual phasing of applications on to ACS, avoiding the high start-up costs normally associated with developing and implementing data communications systems.

It all sounds so much like motherhood and apple pie that one is tempted to wonder if there is a worm in the apple. In fact, there may be several.

For one thing, many of the compatibility, flexibility, network management and low entry threshold features are available from today's carriers. For another, ACS appears at odds with the AT&T philosophy of integrating voice, data and video information into the same network. Finally, how valuable will ACS be to users five or more years hence?

Of course, the question of ACS

availability is clouded by regulatory, legislative and even judicial considerations; so no one knows for sure when, or even if, the service will become operational.

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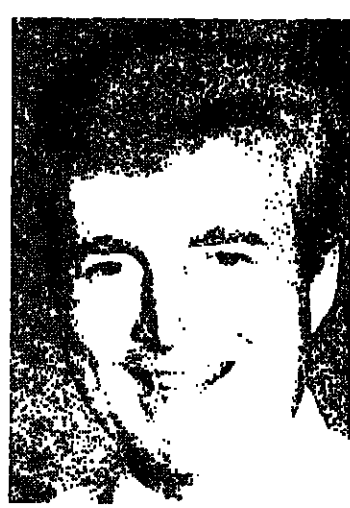
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At the best of times, the FCC



By Morris Edwards

NOW that the initial details of AT&T's Advanced Communications Service have been released, some of the speculation over what was planned with Bell's new data-oriented transmission service has ceased, says US-based consultant Morris Edwards. But some key questions remain unanswered. Here he looks at the outline plans for ACS — and at some matters for the suspicious and quizzical alike to puzzle over.

service. In examining these intentions, one must remember the vast investment AT&T has in the leased lines that make up existing private networks.

For that reason, it is understandable that AT&T projects limited revenues from ACS in the first few years of operation.

AT&T's game plan calls for ACS to attract small users who don't have an existing private network, large users who want to supplement private networks with an application or two involving limited data traffic, and users who want to communicate on an inter-company basis — something difficult to do with existing private networks because of their incompatibility.

In its document on ACS, AT&T underscores the fact that the new service will ease a user's transition from a private network. Other points made incidentally in the document, but which may loom large some day, include the fact that AT&T will supplement ACS with circuit-switched service if the demand exists, and that "ACS is designed to be adaptable to improvements in network technology without impacting user application programs or terminals."

Can it be that ACS is purposely limited in scope, serving as a trial balloon or a precursor to a much grander service waiting in the wings? It certainly makes sense logistically for AT&T to start with a limited packet-switched offering, since implementing a nationwide network service capable of accommodating a wide variety of mainframes and terminals is a mammoth undertaking, especially in the areas of software development and support, which are not traditional strengths of AT&T.

With a slow build-up of customers on ACS, AT&T could "get the bugs out" of the network service without too much disruption. Then, AT&T could add capabilities to ACS in a

manner completely transparent to the user.

What kind of capabilities might be added? One likely possibility is the integration of voice, data and perhaps video, traffic on the network à la Satellite Business Systems, leading ultimately to the "information utility."

The use of the world "utility" comes from the fact that, just as you plug an appliance into an electrical outlet to draw power so the information utility allows you to "plug in" terminals — whether typewriters, facsimile machines, teleprinters or video display devices — to tap a wide variety of information sources.

Another key part of the utility concept is pricing based on usage — an element already present in value-added carrier services. As the distribution facility for the "information age," such a utility could have as much impact as railroads and canals had on the Industrial Revolution.

What does all this mean for the business user? First, in the short term users in the US should not hold their breath waiting for ACS. A good strategy would be to keep ACS in mind as a possible option for future applications, but not to delay any present plans in anticipation of it.

Secondly, in the long term, users should start looking beyond their data processing horizons to see how their organisation's total information needs might best be met.

Already SBS has done quite a bit of groundwork educating US executives to the opportunities afforded by a quasi information utility, and AT&T is committed to a similar effort. As a result, DP managers might soon find additional funds at their disposal to explore alternative communications services, and also greater accessibility to the executive suite.

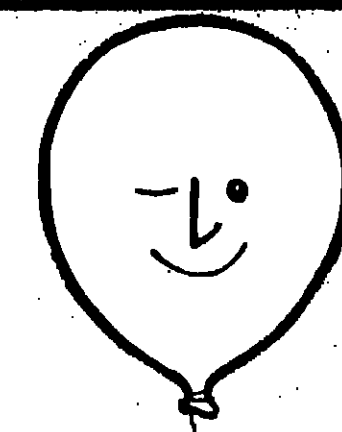
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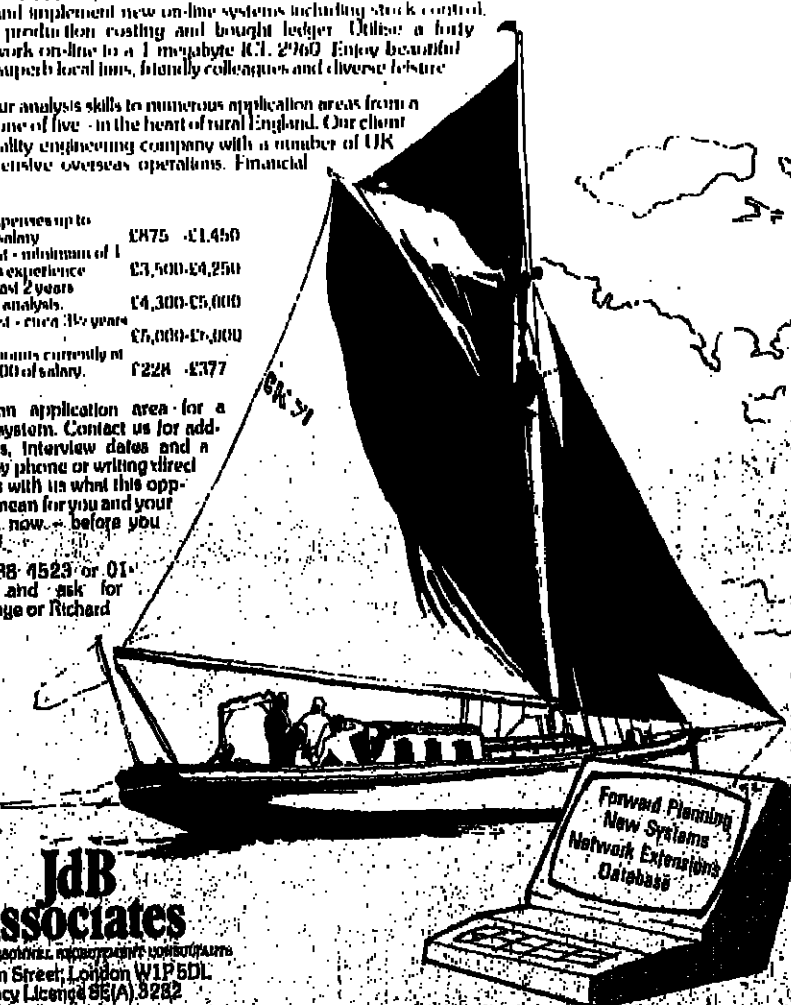
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Tel: 01-834 6821.

## Computer Programmers Saudi Arabia

A challenging assignment worth at least £19000 tax free per two year contract

The operation and maintenance of a sophisticated air traffic control programme is an important aspect of Lockheed Aircraft International's activities in Saudi Arabia, and the challenge offered to experienced personnel is, therefore, considerable.

Additional programmers are required to carry out a wide range of work relating to computerised support systems. The essential requirements are sound experience of LEC or IBM System 3, plus RPG II together with some knowledge of FORTRAN, COBOL, and/or machine language. Business experience, ideally in inventory control, personnel records, flow charts, etc. would also be advantageous.

With the recent increases in salaries and benefits, Lockheed are now able to offer a salary of at least £2341 per annum tax free for a two year contract plus -

- ★ A bonus payment of £500 every six months culminating in an end of contract bonus of £2500, totalling £4000.
- ★ Cost of living allowance of approximately £200 p.a. paid monthly.
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- ★ Free food, laundry and bachelor accommodation.
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- ★ Good recreational facilities.

There are excellent prospects of employment beyond the contract period, and the positions could be accompanied, although terms and conditions will vary from the above.

Write or telephone for an application form, quoting Ref. 751 to IAL Limited, Aeradio House, Hayes Road, Southall, Middlesex. Telephone: 01-874 5000.

GRAPHICAL SOFTWARE  
LIMITED

### TEXT PROCESSING

Experienced programmer required to assist in implementing a sophisticated interactive text-manipulation system using a 16 bit microprocessor programmed in assembly language and BCL.

The successful applicant's programming experience is more likely to have been gained in an academic than a commercial environment. He/she will be self-motivated and willing to work with minimum supervision. Starting salary according to experience in the range £5,000 to £7,000 p.a. Advancement on the basis of achievement and demonstrated potential: salary review 6 months from joining. Year end bonus scheme.

For application form and further details write to Graphical Software Limited, 5 Salisbury Villa, Station Road, Cambridge, or telephone Michael Ewart, 0223 86111 (day time) or 0223 86380 (evening).

### SENIOR OPERATOR

Up to £4,883 p.a.

A Senior Operator is required to form part of the operator/control team shifts running the ICL 2980. A good working knowledge of either VME/B or System 4.2 level is required as well as at least three years' operating/control experience. The Senior Operator acts in all respects as deputy to the Shift Leader and must be able to demonstrate potential shift leader attitude. A two-shift system will be worked and the salary quoted includes the appropriate allowance.

Application forms from Personnel and Management Services Officer, London Borough of Greenwich, Peggy Middleton House, 60 Woolwich New Road, London SE18 6PL Tel. 01-854 9888 Ext. 2119.

Closing date: 31st November 1978  
GREENWICH

TUI  
TOURISTIK UNION  
INTERNATIONAL

### IBM SYSTEMS PROGRAMMERS GERMANY

We are Europe's largest tour operator with almost two million passengers every year. We are now looking for an experienced systems programmer to join our central processing department in Hanover.

Currently installed are an IBM 3033 and 158 running under MVS with JES2-MAS. We have an extensive TP network with ca. 250 local and remote 3270s.

The successful applicant should have experience in some of the following areas:

MVS, TSO, BTAM, CICS, COBOL, JES2 or JES3.

We offer substantial extra benefits, eg. pension scheme, all relocation expenses and considerable travel advantages. A knowledge of German is not essential as the company will provide language tuition.

Interviews will be held in London in the near future. Applications should be sent in writing to:

TOURISTIK UNION INTERNATIONAL  
Zentrales Personalwesen  
Vahrenwalder Str. 12-14  
D-3000 Hannover. Tel. 0511/336 3333

### RACS SYSTEMS PROGRAMMER c. £5,300

The R.A.C.S. is a large progressive retail organisation with a turnover in excess of £125m.

We require additional staff for the new projects being developed on our IBM 370/148. We operate under DOS/VS and CICS/VS and in addition to an on-line system using 3270s we have two retail systems with Point of Sale and other terminals.

The systems programmer will control and maintain installation of varied software releases. Assembler previous systems programming essential.

Programmers should have Assembler or Cobol experience. Knowledge of T/P would be desirable but not essential.

Please write giving details of experience and age to: Financial Controller, Royal Arsenal Co-operative Society, 147 Pavil Street, Woolwich, SE18 7PL. Tel. 01-854 2000, ext. 842 or 418.

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Programmers urgently required for Industrial and Scientific Development.  
£3,800-£5,000.  
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01-854 2000, ext. 842 or 418

oxford polytechnic  
Computer Centre  
Graphics Programmer (2775-2875)

An enthusiastic and experienced programmer is required to join the team of programmers in the Centre. The programmer will be responsible for the provision of software and systems for the students of graphics courses.  
The Centre is currently equipped with an ICL 1903T and two PDP-11 systems with a range of graphics devices. The Polytechnic is currently considering the purchase of new computer systems and the programmer will be responsible for the provision of software and systems for the students of graphics courses.  
Further details and application forms are available from the Deputy Administrator, Oxford Polytechnic, Oxford OX2 0EL.



# Programmers

c. £5,500 p.a.

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Kimberly-Clark is a successful international organisation manufacturing such brand-leading paper products as Kleenex Tissues and Hi-Dri.

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Kimberly-Clark Limited, Makers of Kleenex Tissues

\*Kleenex is a registered trademark of Kimberly-Clark Corp.

## Systems Programmer

Applications are invited to assist in the installation, maintenance and development on the Polytechnic computers which include a DEC-20, 11/40 and a Data General Nova.

A good knowledge of at least one of the high-level languages used at the Polytechnic is necessary (Fortran, Cobol or Basic), together with experience of one assembly language.

Salary: £4481-£4761 plus supplements of £312 p.a. Further details and form of application available from The Assistant Director and Chief Administrative Officer, Trent Polytechnic, Burton Street, Nottingham. Closing date: November 6, 1978.

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To manage and develop systems on an on-line mini computer installation in South Wales

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# Computer Programmers

Saudi Arabia

A challenging assignment worth at least £19000 tax free per two year contract

The operation and maintenance of a sophisticated air traffic control programme is an important aspect of Lockheed Aircraft International's activities in Saudi Arabia, and the challenge offered to experienced personnel is, therefore, considerable.

Additional programmers are required to carry out a wide range of work relating to computerised support systems. The essential requirements are sound experience of LEC or IBM System 3, plus RPG II together with some knowledge of FORTRAN, COBOL and/or machine language. Business experience, ideally in inventory control, personnel records, flow charts, etc. would also be advantageous.

With the recent increases in salaries and benefits, Lockheed are now able to offer a salary of at least £7341 per annum tax free for a two year contract plus —

\* A bonus payment of £500 every six months culminating in an end of contract bonus of £2500, totalling £4000.

\* Cost of living allowance of approximately £200 p.a. paid monthly.

\* Three paid leave periods with three free flights home to the UK annually.

\* Free food, laundry and bachelor accommodation.

\* Free medical care and life insurance.

\* Good recreational facilities.

There are excellent prospects of employment beyond the contract period, and the positions could be accomplished, although terms and conditions will vary from the above.

Write or telephone for an application form, stating Ref. 781 to IAL Limited, Aeradio House, Hayes Road, Southall, Middlesex. Telephone 01-574 5000.

IAL

## GRAPHICAL SOFTWARE LIMITED

TEXT PROCESSING

Experienced programmer required to assist in implementing a sophisticated interactive text-manipulation system using a 16 bit microprocessor system programmed in assembly language and

The successful applicant's programming experience is more likely to have been gained in an academic than a commercial environment. He/she will be self-motivated and capable of working with minimum supervision. Starting salary according to experience in the range £5,000 to £7,000 p.a.

Advancement on the basis of achievement and demonstrated potential; salary review 6 months from joining. Year and bonus scheme.

For application form and further details write to Graphical Software Limited, 6 Salisbury Villas, Sutton Road, Cambridge or telephone Michael Edwards, 0223 66111 (day time) or 0223 66300 (after 6 p.m.).

SENIOR OPERATOR

Up to £4,853 p.a.

A Senior Operator is required to form part of the operator/control clerk shifts running the ICL 2980.

A good working knowledge of either VME/B or System 4 J level is required as well as at least three years' operating/control experience. The Senior Operator acts in all respects as deputy to the Shift Leader and must be able to demonstrate potential shift leader aptitude. A two-shift system will be worked and the salary quoted includes the appropriate allowance.

Application forms from Personnel and: Management Services, Greenwiche, Peggay Middleton House, 80 Newwiche New Road, London SE18 6AQ Tel. 01-854 9888 Ext. 2110.

Closing date: 30th November 1978.

GREENWICH

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ICL Datasilk  
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Prestwich, Manchester

£4,959-£6,025

The North Western Regional Health Authority, requires Systems Analysts to work on a wide variety of systems, both batch and on-line. The option of shift working is available for some of these posts, for which an additional emolument will be paid.

The present installation consists of an ICL 2900 with terminals situated at remote locations. Work is already in progress in developing systems for small computers and reflects the positive attitude of the authority to new concepts and techniques. Future plans include the acquisition of a large 2900 computer in mid-1979.

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Excellent conditions include staff restaurants, recreational facilities, sports and social club, a free car park, a choice of starting times and in certain cases assistance with removal expenses.

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Application forms and job description, etc. may be obtained from the Regional Administrator, North Western Regional Health Authority, Gateway House, Piccadilly South, Manchester M60 7LP, telephone number 061-236 9456, Ext. 425. Closing date 10th November, 1978. Please quote reference number 1658A.

Further information can be obtained from

Eric Sato on 061-773 9211 Ext. 28

North Western Regional Health Authority  
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COMPUTER CENTRE

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## IBM SYSTEMS PROGRAMMERS GERMANY

To £14,000 p.a.

We are Europe's largest tour operator with almost two million passengers every year. We are now looking for an experienced systems programmer to join our central processing department in Hanover.

Currently installed are an IBM 3033 and 158 running under MVS with JES2-MAS. We have an extensive TP network with ca. 250 local and remote 3270s.

The successful applicant should have experience in some of the following areas:

MVS, TSO, BTAM, CICS, COBOL, JES2 or JES3.

We offer substantial extra benefits, eg. pension scheme, all relocation expenses and considerable travel advantages. A knowledge of German is not essential as the company will provide language tuition.

Interviews will be held in London in the near future. Applications should be sent in writing to:

TOURISTIK UNION INTERNATIONAL

Zentrale Personalwesen

Vahrenwalder Str. 12-14

D-3000 Hannover. Tel. 0511/336 3333

## RACS SYSTEMS PROGRAMMER c. £3,300 PROGRAMMERS c. £4,000 to £4,800

The R.A.C.S. is a large progressive retail organisation with a turnover in excess of £125m.

We require additional staff for the new projects being developed on our IBM 370/148. We operate under DOS/VS and CICS/VS and in addition to an on-line system using 3270s we have two retail systems with Point of Sale and other terminals.

The systems programmer will control and maintain installation of varied software releases. Assembler previous systems programming essential.

Programmers should have Assembler or Cobol experience. Knowledge of T/P would be desirable but not essential.

Please write giving details of experience and age, to: Financial Controller, Royal Arsenal Co-operative Society, 147 Powis Street, Woolwich, SE18, or tel: 01-854 2000, ext. 542 or 418.

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Programmers urgently required for industrial and Scientific Development. £3,500-£5,000 p.a. ALL AREAS. Phone for free list of vacancies 637 5551 day, 636 9659 eve.

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Ref: EK 2128 (Consultants)

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UNIVERSITY OF NEWCASTLE UPON TYNE  
DEPARTMENT OF TOWN AND COUNTRY PLANNING  
COMPUTER PROGRAMMER

Applications are invited from graduates with appropriate qualifications and experience for the post of COMPUTER PROGRAMMER in the Department of Town and Country Planning which is a major computer using department within the University. The University operates an IBM 370/158 under DOS and MVS, and the Department has its own terminal facilities. Candidates should have experience of FORTRAN and be able to assist in the teaching and application of simple statistical, modelling and computer graphic techniques.

Salary will be at an appropriate point on the Range 1A scale £3,893.65-£5,155.14 according to qualifications and experience. Membership of the appropriate University superannuation scheme will be required.

Further particulars may be obtained from the Registrar, The University, Newcastle upon Tyne, NE1 7RU, with whom applications (3 copies, together with the name and addresses of three referees, should be lodged not later than 17th November 1978. Please quote reference CW.

THE LONDON HOSPITAL MEDICAL COLLEGE (University of London)

## SUPERVISOR OF COMPUTER SERVICES

Applications are invited for the above post from graduates and/or those holding an appropriate professional qualification.

The appointee will be in charge of the computer section which has a staff of five currently A PDP 11-10 computer used for both local processing and as a remote terminal in the computers in London University.

The post requires both administrative and programming ability, a first degree in mathematics would be helpful though not essential. Applicants should be graduates or have an equivalent qualification in computer science or mathematics.

Salary will be on the Grade B2 scale, £17,117.25 p.a. plus 14.5% London allowance plus annual superannuation within the U.K.

Further details from the Secretary, The London Hospital Medical College, Turner Street, London E1 2AD, telephone 01-37 0633 ext. 47, to whom applications (three copies) together with letters of two referees should be sent within 21 days.

# At last! A new systems challenge where the sky really is the limit

We are British Airports, owners and managers of seven major airports in the UK, including Heathrow and Gatwick.

We are seeking to strengthen our main computer facility at Hayes in Middlesex by recruiting several top-notch Systems Development people.

British Airports was formed as recently as 1966. We've had a computer function since 1971. But we've moved really fast since then.

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You'll be glad to hear that all the basic accounting and statistical systems are safely programmed and out of the way.

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Initially, we are seeking the following:

## Project Manager up to £6,700

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To lead a team of project leaders/analysts and analysts/programmers in developing future on-line systems. Able to compile and integrate ambitious staff.

The job includes control and co-ordination of the feasibility, design, programming and implementation of several systems. Leadership experience at this level is essential. You will also have a say in the selection and implementation of major commercial software, including the ability to manage sub-contracted projects.

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Including productivity bonus

Developing future on-line projects, including feasibility studies, systems design and project implementation. Most of our programming is provided by software houses. You will need enough programming experience to talk to them on an equal footing.

COBOL experience is essential, also a successful record in major commercial systems design and implementation. On-line experience will obviously be an advantage.

Analyst/Programmers up to £5,000

Including productivity bonus

Ideal opportunities for ambitious Programmers who want to hasten their journey up the road to Systems Analyst level. Only 20 per cent of the work you'll be doing will be programming. The rest will be analysis, for which you will receive considerable training, both on the job and in special courses.

If you live in the Brighton area, or would like to move south, one of these jobs could be tailor-made for you. We will be relocating our Offices from Hayes to Gatwick in 1981.

For further details please write or telephone to:

Martin Weston, Personnel Department,

Ref. CW/1, British Airports,

2 Buckingham Gate, London SW1E 6JL.

Tel: 01-834 6821.

British Airports

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## oxford polytechnic

Computer Centre

Graphics Programmer (£3750-£5075)

An enthusiastic and experienced programmer is required to join the team of programmers in the Centre. The programmer will be responsible for the production of software and advising on the purchase of graphics hardware.

The Centre is currently equipped with an ICL 1903T and two PDP-11 systems with a range of graphics devices. The Polytechnic is currently considering the purchase of new computer systems and the programmer will, of course, be part of these exciting new developments.

Further details and application forms are available from the Deputy Administrator, Oxford Polytechnic, Oxford OX2 0BP.



# occ computer personnel limited

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### If you have had Experience Developing:

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In the past they have worked on such diverse projects as

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This diversity of projects means that you could currently be employed by a manufacturer or software house, be working in an academic environment or in the software support group of a large user organisation. Although direct experience in a software orientated environment is very desirable, opportunities do exist for candidates who would like to move into this type of work. The posts are based in London although there will be opportunities to travel both abroad and within the U.K.

For further information or for an informal discussion, please contact Clive Wright on 01-242 9356 or write to the address below quoting Ref 496/CW. If it would be more convenient to telephone in the evening or during the weekend, the number is East Grinstead (0342) 22270



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An exciting programme of development is planned which will include substantial replacement of the existing equipment in the early 1980s.

Applications are invited for the following posts:

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The Centre wishes to appoint a Section Leader and a number of experienced analyst-programmers to work in support and development of operating systems. Initial duties will be in support of Scope 2, 1.3 and R10. The Centre is committed to an active programme of operating systems work and the persons appointed will be expected to make a significant personal contribution to the overall development of the Centre's services.

The work is challenging and involves evaluation and implementation of performance and other service improvements.

For the senior appointment, candidates will be expected to have substantial operating systems experience and be able to demonstrate ability to manage technical projects. Candidates should have a number of years of experience in operating systems or machine level programming and be educated to degree level or equivalent. Experience of CDC equipment is not considered essential.

Salary will be commensurate with age and experience on scale £4131-£7754 (under review) and in the case of the Senior Post would extend to £9261 (under review) plus £450 per annum London Allowance.

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A Programmer-Analyst is required to join a team engaged in the implementation, maintenance and support of application packages including an accounting package. The applicant should preferably be a graduate or postgraduate with a high level of fluency in FORTRAN. The degree should preferably be in a scientific discipline not necessarily computing. Experience of Central Data equipment is not considered essential.

Salary will be commensurate with age and experience on scales £3083-£4654 (under review) plus £450 per annum London Allowance.

The Centre offers excellent conditions of service and operates the University Superannuation Scheme.

Further details and application form are available from the Assistant Secretary, ULCC, 20 Guilford Street, London WC1N 1DZ. Telephone 01-405 8400.

Applications close 15 December 1978

### TREASURER'S DEPARTMENT

### PROGRAMMER

AP4 £4,245-£4,832 p.a.  
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In approved cases there will be assistance with housing, legal and removal expenses, temporary lodging allowance. Staff restaurant, Sports and Social Club. Offices in 47 acres of parkland alongside the River Trent.

Applications giving brief personal and career details, together with the names and addresses of two referees, should be sent to the Personnel Manager, Kelliam Hall, Newark, Notts. NG23 9QX, not later than 7th November, 1978.

Newark District Council

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Location: East London.

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Ref. RW 43/5

### PROGRAMMERS

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## SOFTWARE TECHNIQUES

# My program works -I assert

DURING the past few years we have seen a number of changes in the way we write programs. Many of these ideas have gone under the general banner of structured programming.

If we try to abstract out what this movement has been all about, we soon see that the major change has been a shift of emphasis towards the early parts of the program production process.

In fact, the whole idea has been to design programs so that they have a high probability of being correct, and so to cut down the amount of debugging which has to be done.

The "old hands" at the game will, quite correctly, point out that these techniques have been little more than a formalisation and codification of the best practice of good programmers.

In this article I will introduce another such technique which underlies much of the current research into programming. The technique goes under the name of "Use of assertions and invariants" and we shall see that in embryo form, it has been around for a long time. However, in its new guise it will provide another very strong, useful weapon in the programmer's arsenal. Indeed, if taken to its logical conclusion it could be the start of one of the largest breakthroughs in the program production process.

Let us start by considering three topics with which we are all familiar, that is, comments, modular programming and core dumps. Comments are, of

### By Dan Simpson

course, included in programs to aid the readability of the code and are often used to summarise why we have reached a particular part of the program, and what the next fragment of program will achieve.

Used in this way we can think of comments as a very high level language specification of what is going on in the program with particular details spelled out in the programming language being used.

The concept of modular programming takes a large program and splits it down into functional units, so as to better organise an attack on the program's complexity. This allows us to have a tight specification for each of the fragments of code which are to be used to solve the problem at hand.

The fact that these fragments can be either subroutines or macros only further justifies our idea of the programming language simply being used to spell out details.

The ideas of modular programming and comments come together when programming standards say that the specification of the use of a routine must be given in comments at the start of that routine.

Core dumps provide the final level of detail of the description of the computation. We can take a picture of the contents of storage just before each instruction is obeyed, and so obtain a film of the execution of our program; this is the so called process view of computation.

If we ask ourselves how much use the film so obtained is, we soon come to the conclusion that the answer is "not much".

is the old problem of not being able to see the wood for the trees.

We then may ask ourselves what would be a better level at which to take the film, so as to have just the right amount of detail.

I would suggest to you that the level required is the level at which we inserted comments into our program. That is the level at which we expect the program reader to understand it without the detail of the programming language. In sections of tricky code used to gain some type of efficiency we may well want to look at the film after each high level language statement, as we know that such areas of code are often areas where we may well be susceptible to errors.

The use of assertions and invariants simply ties together the view of computation we have just developed and in doing so formalises the use of comments.

The specification of a program simply defines the input/output requirements and what the program does. The specification of each of our program fragments does exactly the same, and as we know, the programmer's task is to break down the former into uses of the latter. So we may well ask "what's new?"

It is here that we notice that if the program is correct then we should be able to establish a logical relationship between the comments used in the various adjoining fragments of code.

Indeed, the input to our first fragment and output from our last fragment should be exactly the input/output specification of the program, and for the routines within the program the output of one should be exactly the input of the one following.

Thus we get the idea of either augmenting or replacing our comments with strict logical formulae about the states of the variables in our program (our high level core dump idea). Then it should be possible by following the laws of logic to ensure that our program is constructed correctly.

We place into our program assertions of when and how variables change. The variables which should not change, or only change in a systematic way, we call invariants.

From a historical point of view Robert Floyd of Stanford University in 1967 proposed the use of assertions as a way of proving programs correct while Peter Naur of Copenhagen University suggested in 1969 the alternative approach to this idea by using assertions and invariants as specifications of subroutines to ensure that they were used properly.

More recently the work has been taken much further into its theoretical aspects by Tony Hoare of Oxford University, who has done a lot of very valuable work on program proving, and on the axiomatic approach to programming.

This may seem that we are well on our way to being able to prove that programs work. All we have to do is to write out the assertions for each of our routines and by following the rules of logic, we simply work through and then at the end, by now you are asking "Where's the catch?"

The catch is that the theory is not yet sufficiently well developed to take into account all types of programming techniques - side effects are a particularly nasty problem.

But the technique can, and should be used by programmers for two major reasons.

Firstly, it makes quite clear all the assumptions which have been made in writing the program, thus at the program design stage these can be checked back with the user and any anomalies can be sorted out before the program goes live.

Secondly, it makes the programmer's task easier. Further, the theory is not yet

that word "all" in the above sentence. It is not exactly obvious to me how the assertions are to be found. It is often argued that if we cannot find the assertions we do not really understand the solution, and so we should not think we can write a program.

I have a lot of sympathy for this feeling, but not every programmer is skilled in logic and even if the assertions are found, there is still a lot of "leg work" to be done in showing that they follow from each other as they should.

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Secondly, it makes the programmer's task easier. Further, the theory is not yet

Parallel processing systems and applications of microcode have stood out as recurrent themes in the software activity of the last year.

Microcode, in the guise of firmware, has attracted the attention not only of the industry, for its increasing role in IBM operating systems, but also that of the EEC, which was concerned with the possible impact on minicomputer software portability (Software File, August 17).

In this supplement, we examine IBM's use of firmware (page 32, 33) as well as reviewing the basic capabilities and limitations of microcode itself (page 34).

Parallel processing has surfaced particularly in discussions of "dataflow" architecture and distributed operating systems such as the NPL's Demos (Software File, July 27). As an investigation of the implications for programming, we look at what is likely to be one of the first end-user systems, ICL's Distributed Array Processor (page 35).

Finally, on this page, Dan Simpson of Sheffield Polytechnic discussed a method of program development which has recurred strikingly as the major theme of recent computer science gatherings.



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OFFICIAL



Microcode, also known as firmware, is by no means a new idea, although IBM has recently emphasised its importance by exploiting it as a competitive tool in its battle with the plug-compatible mainframe manufacturers.

John Spencer, publications director at Infotech International, examines the price/performance arguments for the use of microcode and takes a close look at some of IBM's ulterior marketing motives behind the use of microcode.

The material used in this article was derived from the Infotech State of the Art Report "IBM" published this month.

DURING the past fifteen years, computer architects have found it quite advantageous to design low- and medium-performance computers with an elementary repertoire of micro instructions, sequences of which represent ordinary machine instructions available to the user.

Microcode is flexible and expandable. If the original design of a computer lacks machine instructions later found to be desirable, they can be designed cheaply and field-installed merely by adding new sequences of micro instructions.

This became IBM's belated strategy for moving customers from second generation 7070s, 7080s, 1401s, etc to the 360. IBM added this emulation firmware to many 360 models two to three years after they were originally designed, so that customers could run their production programmes while developing new native-mode programs.

Recently IBM has disclosed its strategy for moving customers from the older 360 and 370 computers to the next mainframe generation: emulation of control program "hot spots" (frequently-executed supervisory routines which cause performance losses). On smaller-scale operating systems (OS/VS1 and VM/370), IBM offers Extended Control Program Support (ECPS) an inexpensive collection of firmware routines.

For its largest operating system, MVS, IBM offers both firmware routines (extended facility) and conventional software improvements (systems extensions) for the 370/158, 168 and the 3030 series.

On the 370/168, the use of MVS/SE is claimed to improve performance approximately 14% for a \$85,000 purchase price tag, or about 2% to 4% price increase over the combined price of the 370/168 CPU and memory.

Thus this product, which consists of about a dozen micro-coded instructions replacing parts of the operating system, improves the performance to price ratio of the 370/168 system.

With IBM's "state-of-the-art" operating systems, approximately only one-third of the full computational power is used in program ("user") state. Furthermore, OS/MVS and VM/370 typically have little "contingency reserve" of CPU power, since they run, respectively, at 85% and 80% CPU utilisation at an average well-tuned customer site.

If an installation cannot meet its batch throughput commitments with MVS on its current processor, it has only two alternatives: 1. adding a CPU (a less expensive Attached Processor System, or a very costly Multiprocessor System) and

# Role of microcode in IBM's marketing plans

By John Spencer

upgrading to the next level of CPU: 158 to 168, 168 to 3033, etc.

By moving "hot spot" functions from ordinary supervisory software into firmware, IBM can achieve two cost-performance goals for its customers: 1. reduce the supervisory percentage of CPU activity; and, 2. raise the user-state percentage of CPU activity.

It must be emphasised how important the second cost/performance goal is to batch throughput. A hypothetical increase from, say, 34% to 40% corresponds to an 18% increase

in batch throughput per hour, per day, or per annum.

This gain is fundamentally independent of the CPU supervisory percentage, CPU inactivity percentage ("wait state") numbers and speeds of peripherals and other factors.

Four types of software components are currently being microcoded by IBM:

1. general supervisory "hot spots" including virtual storage management (GETMAIN/FREEMAIN), main-storage management (page allocation/deallocation) and presentation

and synchronisation of I/O requests (EXCP/WAIT);

2. channel programming "hot spots" including interpretation of channel programs into real addresses, fixing relevant pages into real storage and responding to I/O interruptions and consequent "reverse interpretation" into virtual addresses;

3. assistance to special VM/370 "hot spots"; and

4. interpretation of APL.

The table in Figure 1 shows where IBM has invested in each of the above types of firmware. The approximate reductions in

supervisory overhead are shown in Figure 2.

IBM has probably exploited ECPS and 11 as much as can be cost effective with the basic 370 architecture.

The price/performance benefits outlined above are only part of the rationale behind IBM's use of microcoding techniques. A number of marketing objectives can also be identified, namely to:

1. render 370 mainframes obsolete;

2. encourage customer migration to the newest OS;

OS	Extended control program support	Extended facility	APL assist	Figure 1. Types of firmware.
OS/VS	—	—	—	
OS/VS1	(1)-(3)	—	(4)	
OS/MVS	(1)-(3)	—	(4)	
VM/370	—	—	—	
OS	Microcoded	ECPS	APL	Figure 2. Percentage of reductions in supervisory overhead due to microcoding OS.
OS/VS1	—	15	—	
OS/MVS	—	—	0	
VM/370	40	—	0	

3. offset the price/performance advantage of "look-alike" mainframes;

4. strongly protect designs of the newest OS by patenting new firmware;

5. thereby deny this OS to "look-alike" competitors, who must copy the firmware design in order to use the OS; and,

6. later, raise prices considerably for the firmware and corresponding OS.

Along with other major mainframe manufacturers, IBM in recent years has followed a strategy of unbundling and

modularisation in system design.

The chief reason for the rapid acceleration of modularisation is the proprietary edge it will return to the larger suppliers who will foster it because they can control the pricing structure.

Except for the interfaces with the application programs already written by the customer, which are almost inviolable over the shorter term, the interface between modules and changes in those interfaces may be controlled by the supplier in such a

way as to put the plug-compatible products of the smaller independent companies in jeopardy.

The risks of litigation against such actions will be reduced by the offering of performance improvements with new modules and by the complexity of explaining the technological concepts to a judge or jury, which gives the large companies a psychological advantage.

This advantage has been evident in the trial of several of the peripheral manufacturer and Government suits against IBM;

the complexities, and therefore the advantage, are increased when concepts such as operating system software, microcode, hardware, and trade-offs among them are involved.

The large mainframe manufacturers such as IBM will keep making changes in module interfaces, permitting them to leapfrog independent companies that attempt to duplicate certain isolated modules and thus to displace the products of the larger companies.

This possibly continuous

leapfrog strategy has already emerged in the struggle of the manufacturers of plug-compatible CPUs against IBM.

The MVS/SE mentioned above is one example of the implementation of this strategy by IBM. MVS/SE offers the user performance improvement for a price, and alters the interfacing of the operating system with the hardware so as to create an advantage over the plug-compatible CPU manufacturers which use the traditional bundled, and therefore free, operating system.

Through the performance improvement, IBM justifies to the customer taking the software or, in this case, the microcode out of the public domain, and, at the same time, it puts the plug-compatible CPU manufacturers at a disadvantage.

Naturally, the PCs can respond with performance improvements in their systems to maintain their competitive positions. They may do so in several ways, including the following:

1. improving the operating performance of the hard-wired part of the plug-compatible unit while maintaining the price;

2. microcoding other parts of the operating system so as to generate performance improvement; and,

3. replicating the new microcode of IBM through reverse engineering.

All of these possible responses could put some pressure on margins, and all would involve some time delays.

For example, reverse engineering of the microcode would probably require many months. From the time the independent company first obtains the technical specifications of the IBM Microcode which would be at the time the first deliveries of the IBM product, it could take from three to 12 months to duplicate the microcode module, depending on how complicated and sophisticated the microcode functions are.

Thus the independent company probably have a reverse engineered product ready within months to two years following the IBM announcement, assuming the time between the IBM announcement and the first customer shipment is from three months to a year.

Whether or not IBM will be successful in this strategy open to question, IBM has continually been surprised by the competitiveness, strength, and flexibility shown by independent companies.

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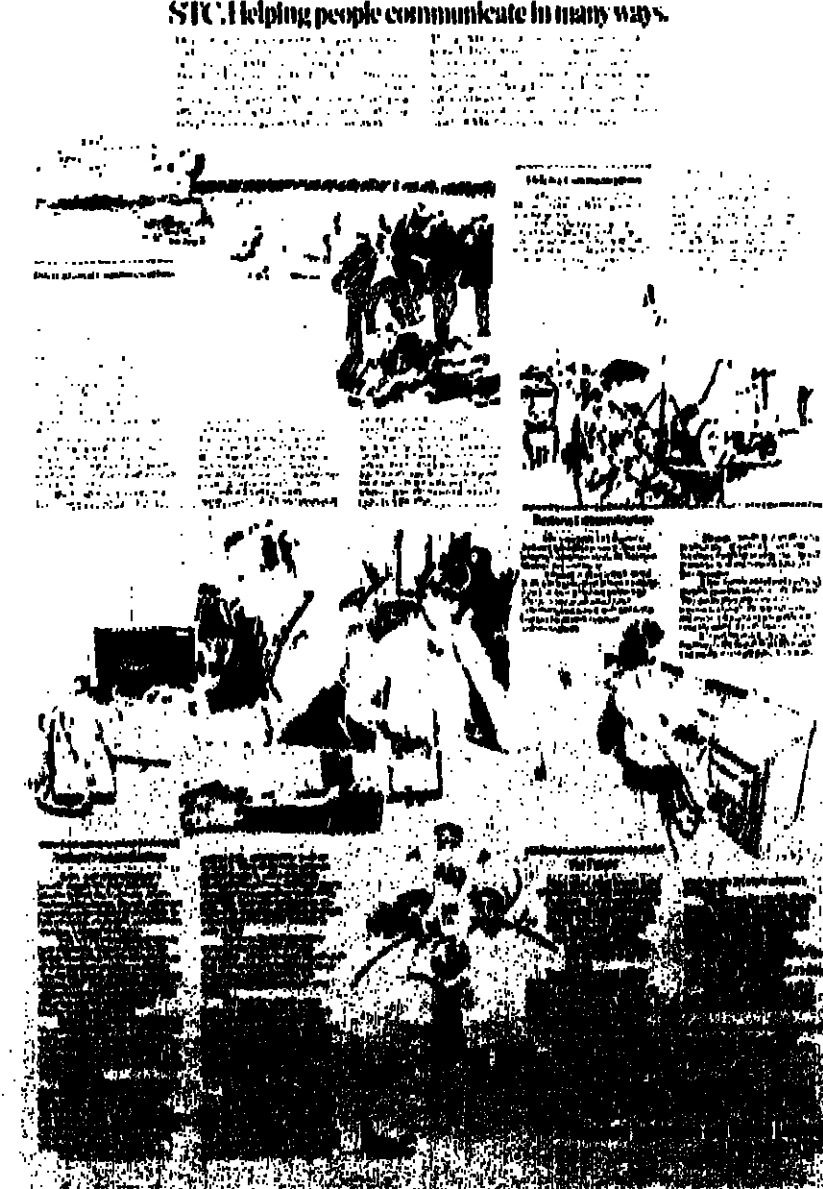
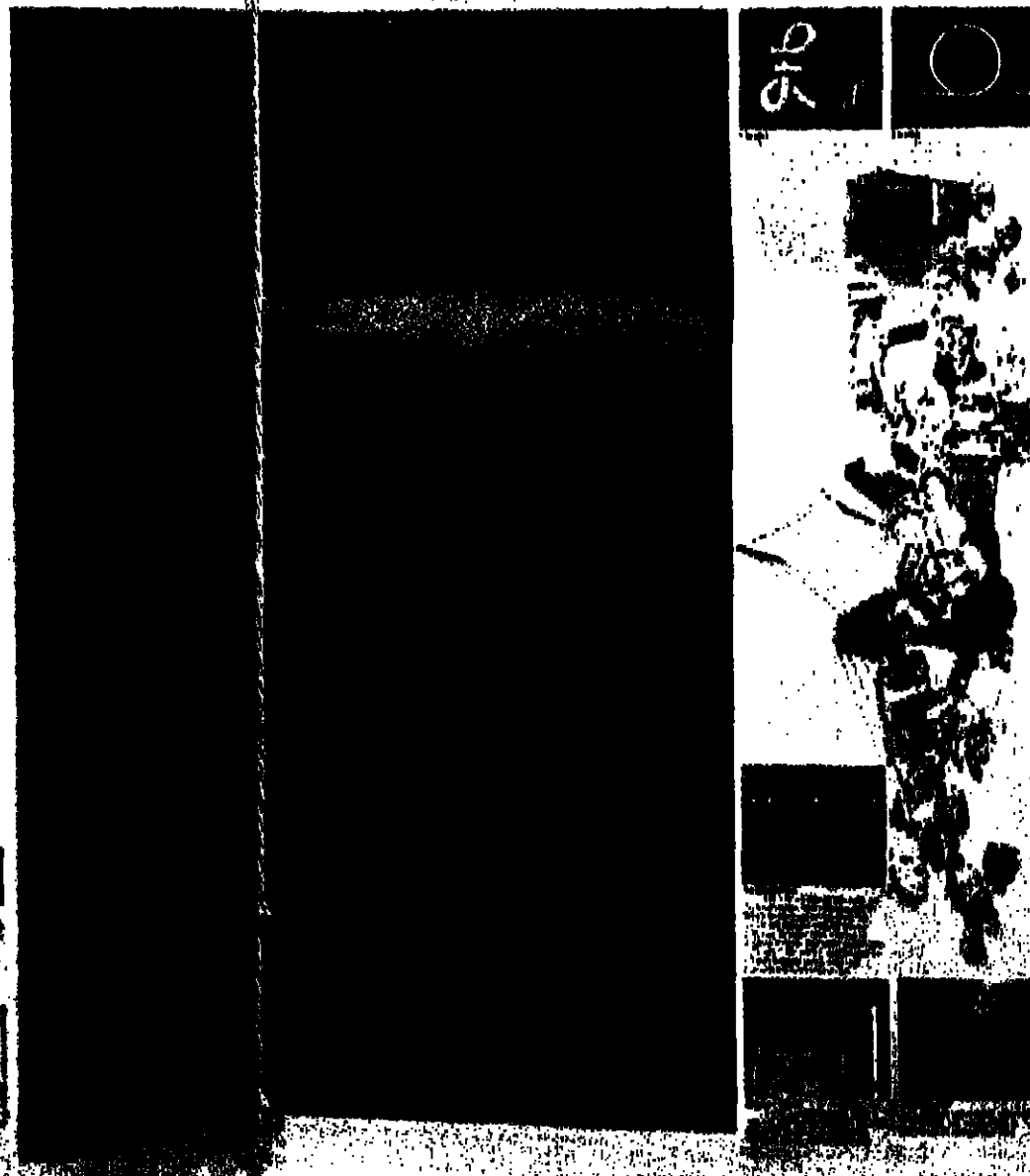
Intel's Advanced System series, for example, on a one-for-one basis, has as much if not more microcode capability than the equivalent IBM machine.

For example, the 3031 has microcode address limitation of 8K words. The words are 78-b long, 72 of which are used for microprogramming. (The 3031 uses the same microcode word as the 168, which also had the limitation.) Intel does not have this limitation, and consequently the Intel 7031 will have improved virtual machine system even though it and the 3031 may be equivalent in hardware terms.

Users running VM/370 should find that it will perform better on the Intel machine than it does on the IBM machine because the microcode assist function on the Intel machine will be more extensive.

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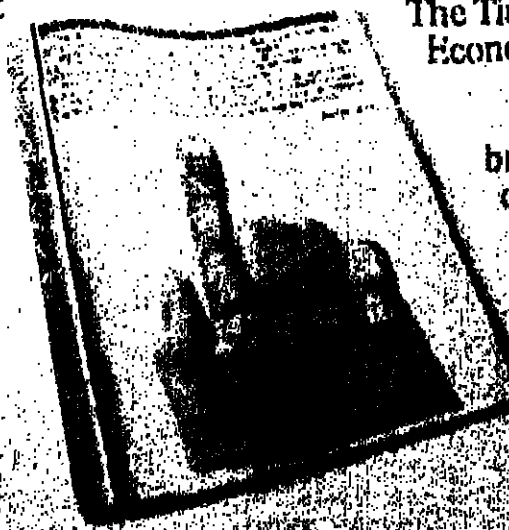
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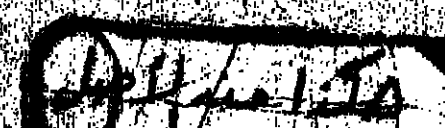
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Microcode, also known as firmware, is by no means a new idea, although IBM has recently emphasised its importance by exploiting it as a competitive tool in its battle with the plug-compatible mainframe manufacturers.

John Spencer, publications director at Infotech International, examines the price/performance arguments for the use of microcode and takes a close look at some of IBM's ulterior marketing motives behind the use of microcode.

The material used in this article was derived from the Infotech State of the Art Report "IBM" published this month.

DURING the past fifteen years, computer architects have found it quite advantageous to design low- and medium-performance computers with an elementary repertoire of micro instructions, sequences of which represent ordinary machine instructions available to the user.

Microcode is flexible and expandable. If the original design of a computer lacks machine instructions later found to be desirable, they can be designed cheaply and field-installed merely by adding new sequences of micro instructions.

This became IBM's related strategy for moving customers from second generation 7070s, 7080s, 1401s, etc to the 360. IBM added this emulation firmware to many 360 models two to three years after they were originally designed, so that customers could run their production programmes while developing new native-mode programs.

Recently IBM has disclosed its strategy for moving customers from the older 360 and 370 computers to the next mainframe generation: emulation of control program "hot spots" (frequently-executed supervisory routines which cause performance losses). On smaller-scale operating systems (OS/VS1 and VM/370), IBM offers Extended Control Program Support (ECPS) an inexpensive collection of firmware routines.

For its largest operating system, MVS, IBM offers both firmware routines (extended facility) and conventional software improvements (systems extensions) for the 370/158, 168 and the 3030 series.

On the 370/168, the use of MVS/SE is claimed to improve performance approximately 14% for a \$65,000 purchase price tag, or about 2% to 4% price increase over the combined price of the 370/168 CPU and memory.

Thus this product, which consists of about a dozen micro-coded instructions replacing parts of the operating system, improves the performance to price ratio of the 370/168 system.

With IBM's "state-of-the-art" operating systems, approximately only one-third of the full computational power is used in program ("user") state. Furthermore, OS/MVS and VM/370 typically have little "contingency reserve" of CPU power, since they run, respectively, at 85% and 80% CPU utilisation at an average well-tuned customer site.

If an installation cannot meet its batch throughput commitments with MVS on its current processor, it has only two alternatives: 1. adding a CPU (a less-expensive Attached Processor System, or a very costly Multiprocessor System); and, 2.

# Role of microcode in IBM's marketing plans By John Spencer

upgrading to the next level of CPU: 158 to 168, 168 to 3030, etc.

By moving "hot spot" functions from ordinary supervisory software into firmware, IBM can achieve two cost-performance goals for its customers: 1. reduce the supervisory percentage of CPU activity; and, 2. raise the user-state percentage of CPU activity.

It must be emphasised how important the second cost-performance goal is to batch throughput. A hypothetical increase from, say, 34% to 40% corresponds to an 18% increase

in batch throughput per hour, per day, or per annum.

This gain is fundamentally independent of the CPU supervisory percentage, CPU inactivity percentage ("wait state") numbers and speeds of peripherals and other factors.

Four types of software components are currently being microcoded by IBM:

1. general supervisory "hot spots" including virtual storage management (GETMAIN/FREEMAIN), main-storage management (page allocation/deallocation) and presentation

and synchronisation of I/O requests (EXCP/WAIT);

2. channel programming "hot spots" including interpretation of channel programs into real addresses, fixing relevant pages into real storage and responding to I/O interruptions and consequent "reverse interpretation" into virtual addresses;

3. assistance to special VM/370 "hot spots"; and

4. interpretation of APL.

The table in Figure 1 shows where IBM has invested in each of the above types of firmware. The approximate reductions in

supervisory overhead are shown in Figure 2.

IBM has probably exploited ECPS and EE as much as can be cost effective with the base CTO architecture.

The price performance benefits outlined above are only part of the rationale behind IBM's use of microcoding techniques. A number of marketing objectives can also be identified, namely to:

1. render 370 mainframes obsolete;

2. encourage customer migration to the newest OS,

OS	Extended control program support	APL assist	Figure 1. Types of firmware.
OS/VS1	(1)(2)	(4)	
OS/MVS	(1)(3)	(4)	
VM/370	(1)(3)	(4)	

OS	Microcoded by	APL	Figure 2. Percentage of reductions in supervisory overhead due to microcoding OS.
OS/VS1	ECPS	0	
OS/MVS	ECPS	0	
VM/370	ECPS	0	

3. offset the price/performance advantage of "look-alike" mainframes;

4. strongly protect designs of the newest OS by patenting new firmware;

5. thereby deny this OS to "look-alike" competitors, who must copy the firmware design in order to use the OS; and,

6. later, raise prices considerably for the firmware and corresponding OS.

Along with other major mainframe manufacturers, IBM in recent years has followed a strategy of unbundling and

modularisation in system design. The chief reason for the rapid acceleration of modularisation is the proprietary edge it will return to the larger suppliers who will foster it because they can control the pricing structure.

Except for the interfaces with the application programs already written by the customer, which are almost inviolable over the shorter term, the interface between modules and changes in those interfaces may be controlled by the supplier in such a

way as to put the plug-compatible products of the smaller independent companies in jeopardy.

The risks of litigation against such actions will be reduced by the offering of performance improvements with new modules and by the complexity of explaining the technological concepts to a judge or jury, which gives the large companies a psychological advantage.

This advantage has been evident in the trial of several of the peripheral manufacturer and Government suits against IBM;

the complexities, and therefore the advantage, are increased when concepts such as operating system software, microcode, hardware, and trade-offs among them are involved.

The large mainframe manufacturers as IBM will keep making changes in module interfaces, permitting them to leapfrog independent companies that attempt to duplicate certain isolated modules and thus to displace the products of the larger companies.

This possibly continuous

leapfrog strategy has already emerged in the struggle of the manufacturers of plug-compatible CPUs against IBM.

The MVS/SE mentioned above is one example of the implementation of this strategy by IBM. MVS/SE offers the user performance improvement for a price, and alters the interfacing of the operating system with the hardware so as to create an advantage over the plug-compatible CPU manufacturers, which use the traditional bundled, and therefore free, operating system.

Through the performance improvement, IBM justifies to the customer taking the software or, in this case, the microcode out of the public domain, and, at the same time, it puts the plug-compatible CPU manufacturers at a disadvantage.

Naturally, the PCMs can respond with performance improvements in their systems to maintain their competitive positions. They may do so in several ways, including the following:

1. improving the operating performances of the hard-wired part of the plug-compatible unit while maintaining the price;

2. microcoding other parts of the operating system so as to generate a performance improvement; and,

3. replicating the new microcode of IBM through reverse engineering.

All of these possible responses could put some pressure on margins, and all would involve some time delays.

For example, reverse engineering of the microcode would probably require many months. From the time the independent company first obtains the technical specifications of the IBM Microcode which would be at the time of the first deliveries of the IBM product, it could take from three to 12 months to duplicate the microcode module, depending on how complicated and sophisticated the microcode functions are.

Thus the independent could probably have a reverse engineered product ready within six months to two years following the IBM announcement, assuming the time between the IBM announcement and the first customer shipment is from three months to a year.

Whether or not IBM will be successful in this strategy is open to question. IBM has continually been surprised by the competitiveness, strength and flexibility shown by independent data.

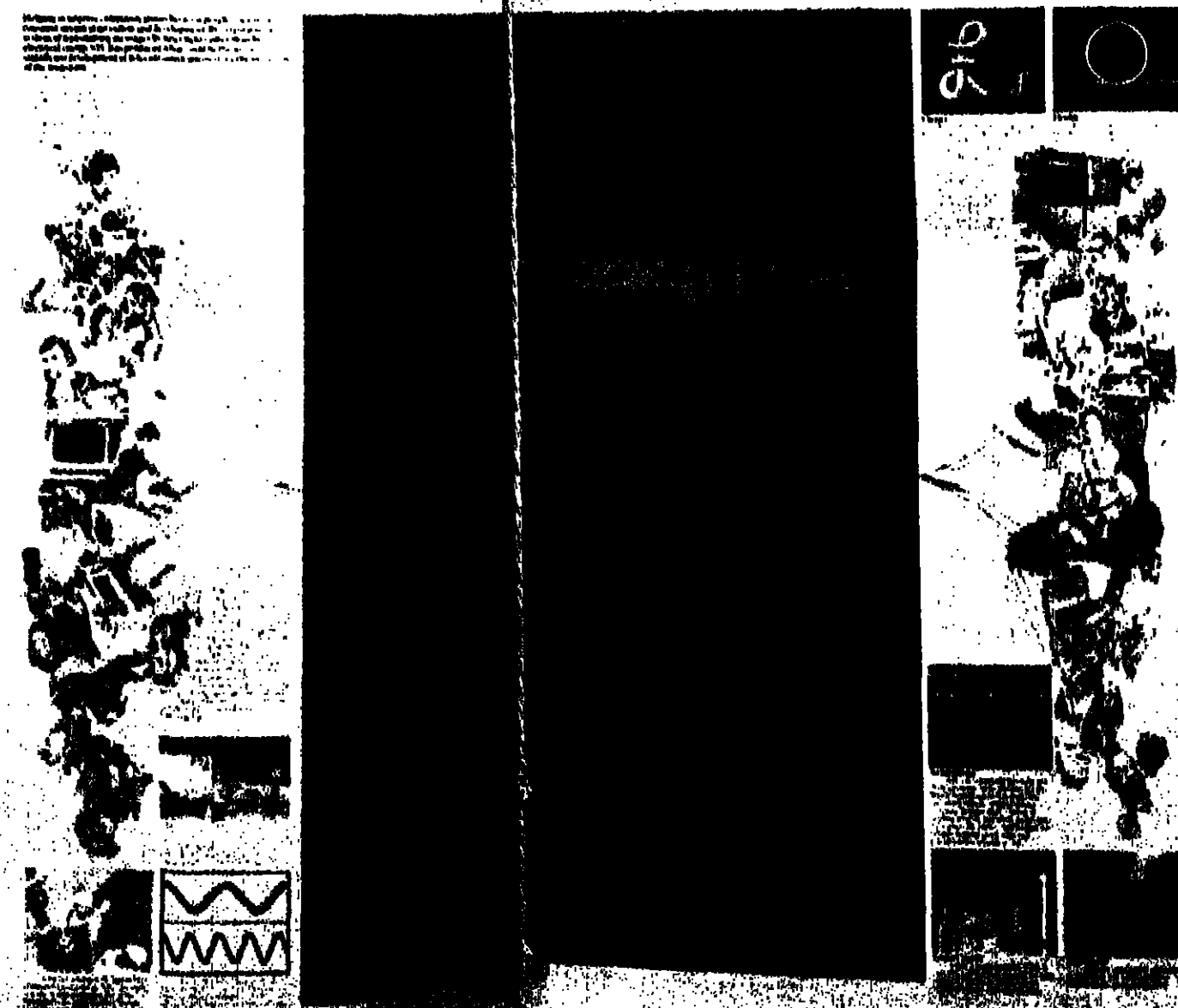
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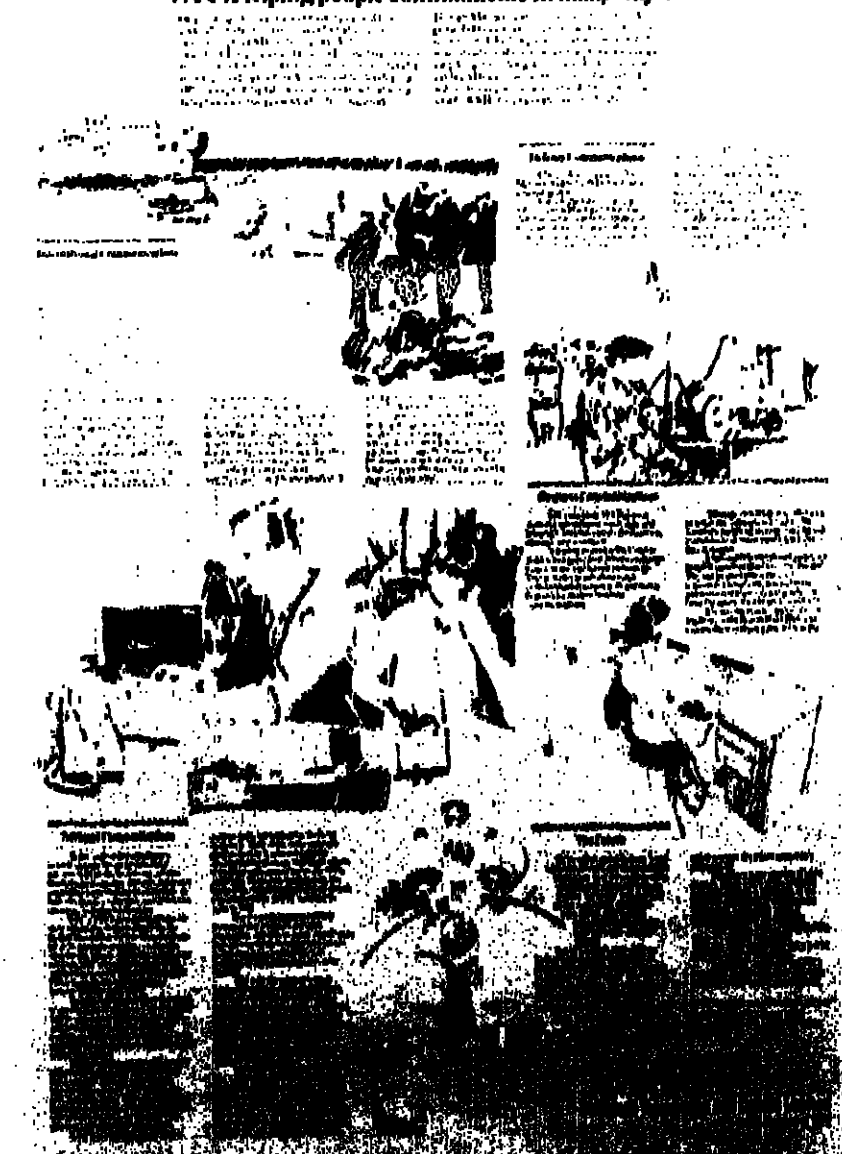
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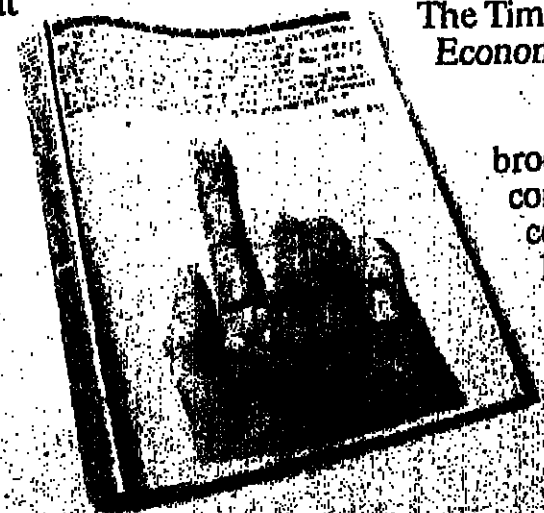
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# Benefits of using firmware effectively

By Jon Kerridge

THERE has recently been a lot of interest in the use of microcode (or firmware) in computers and computer operating systems. In this article I will try to explain what microcode is, why it is used, and what benefits are to be gained by using it.

In the same way that a program is a sequence of micro-instructions. Take for example an instruction which loads a memory location with a value from a user register.

In order that this instruction can be executed, the following micro-instructions have to be obeyed:

1. the address of the required memory location has to be placed in a memory address register;
2. the contents of the user register have to be transferred to a memory buffer register; and,
3. the memory has to be written activated which causes the contents of the buffer register to be placed at the location specified in the address register.

machine language programs. It also means, incidentally, machine language is not the lowest level of programming. There is a micro-instruction for each transfer path and operation in a computer. By combining some of these micro-instructions into a sequence, specific machine language instructions can be created.

The process of generating these sequences is called microcoding. Each machine instruction therefore, has associated with it a specific sequence of micro-instructions. The microcode of a computer comprises all the micro-instruction sequences needed to specify all the machine instructions.

The microcode can be stored in two ways. Firstly, it can be built into the electronics of the computer. This has the advantage of being very fast when obeyed, but it is difficult or impossible to change. Secondly, sequences can be stored in a special, fast micro-instruction memory, a particular sequence being obeyed when the related machine instruction is required. This second method has the advantage of

being more flexible because the memory can be easily changed, but it is slower when it is executed, because the memory has to be accessed.

Microcoding is common to all computers, what varies is whether it is implemented by electronic circuitry or a special memory. It is when all or part of the microcode is stored in a memory that it becomes useful in what can be done with it after the computer has been finally constructed.

The microcode facility of a computer can be used in many different ways including: marketing a range of computers, software security, speeding up throughput and language processing. When a manufacturer introduces a computer to the market, he does so as a family of computers with different capabilities. The usual formula is, discounting such things as peripherals, store size and software, the higher up the range the faster the computer.

The single most important aspect of the range is that all members have the same instruction set. This means that software written for one member will run on another member. It also means that by upgrading to another member of the range, the software will run faster, producing the inducement to upgrade.

To achieve this variability of processor speed, the manufacturer provides differing amounts of microcode in hardware. At the low end of the range, many instructions will be software microcoded, thus these instructions execute relatively slowly.

As you go up the range, more of the software micro-coded instructions become hardware micro-coded, and therefore execute more quickly. By deciding which instructions to software microcode a manufacturer can tailor his range of computers to market requirements.

Further, the upgrade to a faster processor will be achieved by removing some of the microcode store and replacing it by the electronic equivalent. A simple matter of changing a few components boards.

One of the major and most costly products of any computer system is its operating system software. Most manufacturers can provide the operating system in ordinary machine language coding, knowing that there is little risk of anybody stealing that software.

However, IBM is the exception, because Amdahl has been producing carbon copy IBM hardware and then using software written by IBM. Much of the initial cost of a computer system is aimed at recovering the software development costs and by this means Amdahl has been saving this cost. IBM has, therefore, implemented parts of recent operating system supervisors in microcode, which are then incorporated into the already existing microcode store.

Hence in the case of some supervisor functions, instead of obeying an ordinary machine language procedure, a call is made upon the microcode store. As a result, the complete source of the operating system is no longer available.

The only way to copy an operating system organised in this way is to copy the microcode store and its contents, a far more difficult task.

This technique also has two beneficial effects for a user, namely, the operating system executes more quickly because the supervisor is microcoded, and it will also be more robust because it is now impossible for a user program to accidentally over-write the supervisor.

Some minicomputers are provided with what is called a writeable control store (WCS). This is a separate memory which is accessible to the general user program in which he can store his own micro-instruction sequences. Normally the microcode store is not accessible by the user.

A user can generate his own micro-instruction sequences, store them in the WCS and then write machine language programs which call these sequences.

The mechanism used is that the user defines a new machine language instruction which are stored as part of the ordinary operation code table so that a correct entry into the WCS can be generated when the program is obeyed.

There are many uses to which a WCS facility can be put, but they are, however, somewhat dependent upon the system being written. In a particular system it may be found that a particular routine or loop is being obeyed very frequently; such a code segment is ideal for microcoding.

By re-writing in microcode that segment will become faster, and hence the overall system speed will improve.

The time which is saved could be crucial in a process control environment in which time is of the essence. It can be used in compilers where one part of the compiler is used very frequently (for example, find next symbol) and microcoding can therefore increase compiler throughput.

Computers which have a WCS will provide a software tool which allows the user to find out which part of his code is most frequently obeyed.

Normally, WCS is only provided on minicomputers, because these machines are ones that get used in dedicated environments where the facility is useful.

In such a situation the

member will run on another member. It also means that by upgrading to another member of the range, the software will run faster, producing the inducement to upgrade.

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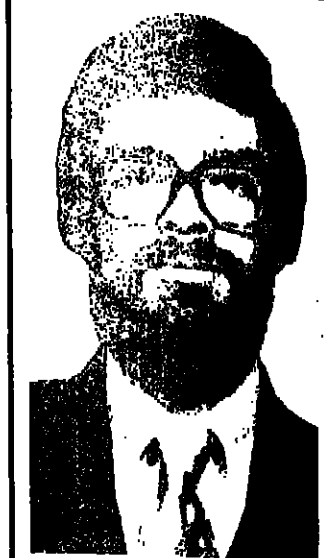
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Interest has increased lately in the use of microcode, also known as firmware, in computers and computer operating systems. Jon Kerridge, a senior lecturer in Sheffield Polytechnic's computer studies department explains what it is and how and where to use it effectively and also dispels some of the confusion surrounding it.

Kerridge's responsibilities include the evaluation of hardware for computer laboratories and lecturing on computer architecture. He is a member of Codasyl's database administration working group (DBAWG) and his current research interests focus principally on microcode simulators and distributed operating systems.

Recent advances in computer architecture for the "super computer" class of machine have all been concerned with the provision of array processing facilities by one of two routes.

While the "classical" route follows the line of the pipelined vector processors, true array processors have been developed which consist of an actual array of small computers working in parallel under the control of a single instruction stream.

Dr R. W. Gostick, a senior languages consultant in ICL's DAP marketing unit, discussed the software requirements of the latest of the true array processor, the ICL Distributed Array Processor (DAP). It is apparent, however, that many of the features of high level languages for array processors are equally relevant to vector processors.

Dr Gostick also concentrates on high level language facilities while giving a brief overview of the operating environment.

# Programs for ICL's Distributed Array Processor

By Dr R.W. Gostick

TO appreciate the operation of DAP, it is necessary to know how DAP exists within a conventional system. Figure 1 shows the DAP as part of a standard ICL 2900 host computer, where it takes the place of a standard 2 Mbyte store module.

The basic hardware concept of DAP, i.e. the association of each of the 64 x 64 (4,096) individual processing elements (PE) with a 4K bit semiconductor 2 Mbyte store module means that the accessed either by the serial 2900 as normal store, or by DAP as "active" or array store. This dual function considerably reduces development required to support a DAP on the host machine.

In particular, all the operating system facilities of the host machine, such as editors, compilers and database facilities, may be used to perform serial processing on data within the DAP store.

The only major modification required to the operating system is to ensure that segments forming part of a DAP program should be loaded into the DAP module in the system.

The actual programming of DAP is carried out in the DAP parallel dialect of standard Fortran language, which is a Fortran subroutine written in DAP Fortran, which then runs on DAP, interface to standard serial language programs running on the 2900 by a simple CALL interface.

Usually the serial program will be written in standard 2900 Fortran, but there is no architectural restriction to the used since 2900 supports full facilities.

Since the data residing in the store may be accessed both by equivalent of "loading" data into the DAP. All data shared by Fortran and DAP Fortran COMMON blocks, and hence the overheads associated with calling the array processor are

minimised.

One major advantage of the integration of the DAP into the store of the 2900 is that the full language-independent, high-level diagnostic system, common to all VME/B high level languages, may be extended very simply to cover DAP Fortran.

This leads to the overall program and diagnostic system shown in Figure 2 and gives, for the first time, the processing power of a super computer with the user diagnostic facilities of a modern operating system integrated on 2900 into a common language independent package, OPEL.

Any manufacturer of a new computer architecture has to decide what high level languages to run on the new hardware. There is, for example, a decision to be made between the adoption and extension of familiar, well-used languages such as Fortran and the use of more recently introduced languages such as APL or Pascal.

However, as the vast majority of super computer users are still dedicated Fortran programmers - more perhaps from habit than from any intrinsic qualities of the language itself - it is essential that all super computers provide a Fortran system as the major programming language.

It is becoming increasingly obvious, however, that the basic serial nature of Fortran is a severe limitation both for the DAP type of array processor and for the vector processors.

Optimising compilers and their extension into vector compilers have been tried as a mechanism for dragging Fortran into the super computer architecture, but even these can fail on such a simple piece of Fortran code as the standard matrix multiplication.

reason DAP Fortran has deliberately been designed to include full array processing facilities.

DAP Fortran recognises two new modes of storage and operation, vector and matrix. A vector is defined as a set of D items, and a matrix is a set of D x D items, where D is the basic dimension of DAP, (D = 64 for the production DAP.)

These new variables are acted on in parallel, and hence for

INTERIOR = ROWS (2,63) AND COLS (2,63)  
X (INTERIOR) = INSIDE - FUNCTION (Y)  
X (NOT INTERIOR) = OUTSIDE - FUNCTION (Y).

Figure 3. An example of declaring and manipulating matrices within DAP Fortran using the familiar logical expressions of Fortran. The underscore character "\_" can be used in DAP Fortran names as a separator to improve legibility.

matrices A, B and C the single DAP Fortran statement:

A = B + C

replaces the conventional Fortran:

```
DO I = 1, 64
DO J = 1, 64
  A(I, J) = B(I, J) + C(I, J)
```

Similar facilities have been added to other extended Fortran compilers, but DAP Fortran adds further new facilities, exploiting the hardware of the DAP to provide high level constructions. One such construction is the provision of shift indexing, replacing Fortran expressions such as A(I + 1, J) by A(+, J), which enables a complete mesh relaxation code to be written as:

X = X (+) + X (-)

The equivalent code in Fortran would require all the well known DO loop overheads, as well as the necessity to consider the edge conditions when, for instance  $I = 1$  in  $A(I + 1, J)$ . In DAP Fortran the edge conditions are handled naturally by allowing the programmer to choose the boundaries by a simple GEOMETRY statement.

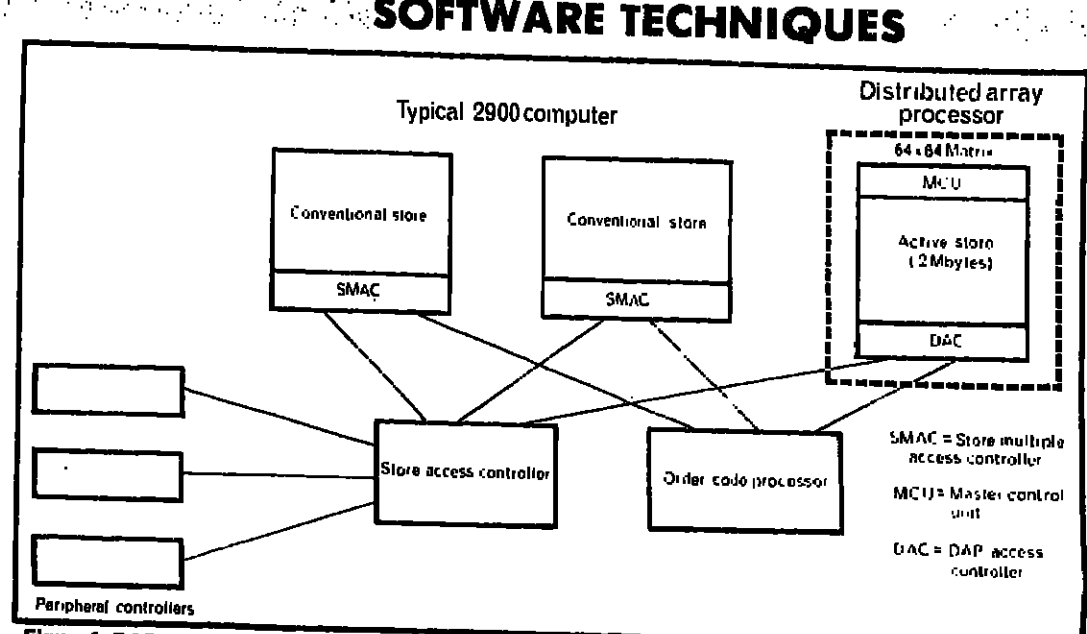


Figure 1. DAP as part of an ICL 2900 "host" computer.

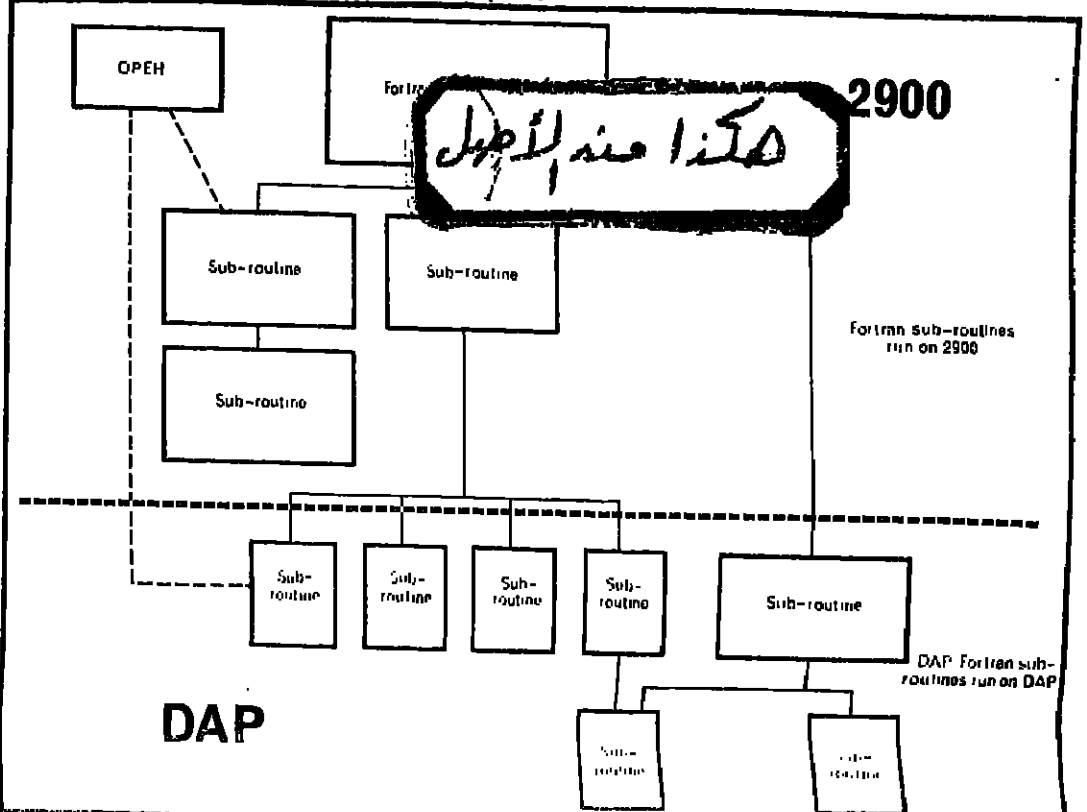


Figure 2. Structure of a program running in DAP and a 2900.

By providing hardware connections between opposite edges of the DAP array, it can be made to simulate mesh problems on a plane, cylindrical or toroidal surface.

The most important feature within the DAP, and within DAP Fortran, is the ability to process

In this case, the two supplied boolean functions: ROWS and COLS have been used. DAP Fortran provides many new functions to aid the high level user, including powerful and efficient global testing functions. The MAX function is extended to work on array (vector or matrix), and can provide the maximum value of a matrix in 500cs, simply by writing:

(S = MAX (A).

The ANY function returns a true value if any element of its logical array argument is true, giving, for example:

IF (ANY (A.GT.0)) CALL SOLVE.

## My program works

from page 31

grammer use simple constructs. We could argue forever whether this is a good or bad thing, and whether it stifles programmer creativity, but if we wish to develop reliable amendable programs, it is a rule we should stick to.

In summary, I am saying that the programmer will have to do a little more work for a lot more pay off. That is, less programming time will be wasted.

However, we have still to face the argument that the tedious algebraic work of showing that the assertions follow correctly from each other must be done. But again we should notice that this is exactly the kind of work which a computer can do very well.

Michael Griffith of Nancy University is here giving us a lead by developing a language and compiler which expects assertions as part of the source program. The compiler checks these assertions and points out any anomalies in the program. It then generates the program, even if it is not a valid program.

This we are observing the development of a technique which helps the programmer produce more reliable programs; of course, the programmer has to learn how to find his assertions, but this is no more difficult than learning to program, indeed it can be argued that it is part of learning to program correctly. We are also seeing the development of languages which make it easy to use the technique.

A lot of the theoretical work has been done and can be found in most books, section 7.3 of Brady's "The theory of computer science" contains a good review and examples.

The topic is being discussed at just about every seminar on programming, and it will not be long now before we see it used by many professional programmers.

The use of assertions is just another tool for producing reliable programs, but its probable major impact will be that it will make it easier to write bad programs.



## COMPUTER OPPORTUNITIES IN SCOTLAND

## Severe lack of skills

SCOTLAND, England or Wales — wherever I go the problem seems to be the same. There is a severe lack of expertise within the DP industry. Is this then a case of one man's meat is another man's poison or perhaps to coin a new phrase "the employee's dream is the employer's nightmare"? I don't believe that it works like that. Unfortunately, an unbalanced market works against both sides and many careers have suffered severely because of the DP staff market situation.

We are going to examine several aspects of the basic subject of recruiting staff with technical expertise, how the present situation helps and hinders the employer, what effect it has on the DP industry, why Scotland is different and what help the government can offer.

Despite the fact that we are all human, it is necessary to consider the situation in the same way that we would any normal marketplace. The seller in this case is also the product. After all, we sell ourselves in return for money to live, just as a manufacturer of carpets sells carpets for money to live. The difference between his selling price and his costs is his profit, the margin on which he lives. In the same way, the difference between the

worker's income and the cost of his necessities is the profit or margin on which he lives.

In any marketplace, where the goods available are substantially less than the demand, the prices rise to reduce the demand — or some bright person steps in and increases the supply. So in the period of short supply, prices, or in this case wages, increase out of proportion to the rest of industry and commerce.

This seems a very rosy picture for the seller — but is it?

Every abnormal market

The second side-effect is that fewer computers are sold, new installations are kept small, existing installations do not upgrade as soon as they should.

The above two points directly hinder the DP person. Work opportunities are often limited to routine financial and commercial applications and therefore real experience does not increase, and because the market expansion is kept down artificially, job security and future promotion prospects are being sacrificed.

From the employer's

By IAN SCOTT and DAVID FISHER  
QRH Software Ltd

situation has very obvious benefits to one side and major drawbacks to the other. However, it is very rare to find that either side finds only advantages. We believe that the DP professional has suffered in various ways, but we think that there are two major negatives.

The first, as a buyer in an unbalanced market, often your only course of action is to reduce your needs. Many DP installations have remained small to avoid the staff shortage problem. Many applications which would have been computerised have been handled by "some other method" to minimise the problem.

point of view the market is no different from any other. Does he have to employ people who are going to cost him more every year, people whose next 12 months' costs cannot be forecast accurately?

In the time of crisis we find alternatives. Several have been taken in the past, and because the market isn't changing, will continue to be taken.

The effect on the DP industry is a very important one. If prospective users find solutions, ways of minimising the use of computers, then the demand for computers is affected. This reduces the marketplace. It therefore follows that if the

DP industry were to overcome the staff shortage problem then the market size would increase to its real size, as one of the major constraints will have been removed.

We have taken a long time to get round to Scotland. We have gone through the points above first because they relate to the whole of Britain. Scotland is just the same as anywhere else in most respects of the DP expert market. However, it does differ in some important ways.

Scotland is a nation well served with beautiful countryside, mountains and lochs. It is a joy to be in most areas — to walk, to drive, sail or just sit back and drink in the breathtaking scenery. This often unspoiled beauty can, however, work heavily against industry, the DP industry no exception.

Unlike some parts of Britain where industry is concentrated into large centres and population is high, the major industrial areas of Scotland are often isolated, eliminating the opportunity for people to move place of work easily.

With this situation it is easy for a DP person to become an expert in a particular field only to find that the only place to sell his services is away from his home area. The same problem affects the employer.

He may develop an installation with a need for particular expertise only to find he cannot get that expertise.

A restricted market as a result of staff shortage also affects employment in Scotland significantly. A number of major computer companies manufacture computers, peripheral equipment or parts in factories in Scotland. Expansion of the market would increase the number of jobs available within the manufacturing side of the computer industry.

What can be done about the present situation?

A number of very positive things can be done. Action now will eliminate the problem and help reduce unemployment throughout Britain, and as Scotland is a region with more than its share of unemployment problems, it would be one of the first areas to benefit.

During the last nine months our company, which employs some 30 people, has recruited 10 trainees and we have spent considerable time and effort in training these young people for a career in DP.

Having spent a little time in writing to various universities and generally letting Job Centres and various organisations know we were looking for trainee programmers, we have had an incredible response.

From most parts of Britain, and particularly from Scotland, over 150 people have written, telephoned or just walked in to our offices. Many who replied were ideally suited to the opportunities we were able to offer, but unfortunately there is a limit to the number of people that one can support in training at any one time.

As a nation we spend substantial sums of money retraining people who have been out of full-time education for a number of years through the TOPS courses. These include one for computer programmers. This is an 18-week course involving training in COBOL, Plan Assembler and RPG II (see this page). We have no official figures, but the cost

per head must exceed £3,000. The trainee studies four separate languages. In addition to this the government pays many employers in certain industries employment grants to take on trainees.

How many companies like ours would willingly train more people if this finance were made available to the DP industry? We agree special checks would have to be made before grants could be made. As an industry we have no recognised apprenticeships for our new people. It would have to be restricted to companies employing a number of fully experienced DP professionals. And before the grant was paid, how about a written exam?

This may not be the full answer, but it would certainly encourage employers to train people.

The whole country could benefit. We have now waited a long time for action. Why not now?

## Topping up the pool

A CHANCE for people who have worked in other industries to enter into computing, and break the vicious circle of "no experience — no job," is the aim of a training course run in Glasgow by Allan D'Morias under the Manpower Services Commission's TOPS scheme.

Students are aged between 19 and 35 and all have previous work experience. They study at an ADM training school for 11 weeks, and spend a further nine weeks working in user installations, where they gain experience — and in addition these potential employers get a chance to assess them.

The course covers the technical concepts of computing, programming techniques, business principles, and the fundamentals of systems analysis and design. Its intention is to enable students to take up junior programming jobs, and in nine months of existence so far all students have been successfully placed. Only one in four of those who apply for the course is accepted.

ROBERT GORDON'S  
INSTITUTE OF  
TECHNOLOGY, ABERDEEN  
COMPUTER  
SERVICES UNIT

ASSISTANT  
PROGRAMMER

A vacancy exists in the Computer Services Unit for the above post, to assist in developing application programs in support of the Institute's teaching commitment. These applications are primarily written in COBOL and run on the Institute's DECsystem-20 computer.

Salary scale £2550-£3275 per annum. Local Government Superannuation Scheme. Application forms and further particulars are available from the Chief Administrative Officer, Robert Gordon's Institute of Technology, Schoolhill, ABERDEEN AB9 1FR.

WALES AND  
WEST COUNTRY  
RECRUITMENT  
FEATURE

Advertisers are reminded that the next Computer Weekly area feature will be published on November 23 and will highlight career opportunities in Wales and the West Country.

Space reservations should be made as soon as possible to:

Basil MacGowan  
Birmingham—021-356 4838  
Eddie Farrell  
London—01-261 8097

Copy Deadline: PM Friday before

COMPUTER WEEKLY

THE INDUSTRY'S WIDEST READ AND MOST REQUESTED PUBLICATION

Further  
Appointments  
appear  
on  
pages

23, 24, 25

26, 27

28, 29, 30

## ADVERTISERS' ANNOUNCEMENT

Allan D'Morias &  
Associates Ltd.OPENING OF THEIR  
GLASGOW OFFICE

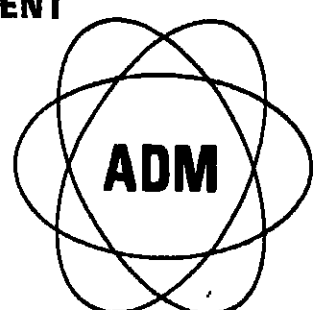
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## COMPUTER OPPORTUNITIES IN SCOTLAND

## ANALYSTS

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QRH SOFTWARE LTD.  
HALIFAX (0422) 58231 (10 lines)  
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Programmers  
Exploration/Computing

The British National Oil Corporation's wide ranging involvement in the offshore oil industry includes the largest exploration commitment in the UK Continental Shelf. This function is serviced by a specialised SEL

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Applications are invited from those who:

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- are familiar with the use of FORTRAN
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A career with BNOC offers unusually attractive career development opportunities. Salaries and conditions of employment together with relocation expenses, where appropriate, form an attractive package. If you are interested in one of these posts please write or telephone for an application form quoting reference P/EC/KM/CW to:

The Group Personnel Manager,  
THE BRITISH NATIONAL OIL CORPORATION  
150 St. Vincent Street,  
GLASGOW  
G2 5LJ.  
Telephone 041-204 2625

This position is open to male and female candidates.

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This well-known engineering company seeks to engage

SYSTEMS  
ANALYSTS

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The company's configuration is an ICL 2904 with 96K store and EDS 60s supporting batch operations and DDE stations, with three 7502 terminals handling on-line applications.

Please write stating brief career history and qualifications to

The Personnel Manager, Anderson Strathclyde Limited, 47 Broad Street, Glasgow G40 2QW.

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Brief but comprehensive details of career and salary to date, which will be treated in confidence, should be sent to C. R. Williams, Executive Selection Division, ref: M934, at the address below. Please include a daytime telephone number at which you may be contacted.

COOPERS & LYBRAND ASSOCIATES (SCOTLAND) LTD.  
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Highland House, Waterloo Street, Glasgow, G2 7DB.

UNIVERSITY OF ABERDEEN  
COMPUTING CENTRE

## SENIOR PROGRAMMING ADVISER

The University has recently installed a large Honeywell dual processor 66/80 System supporting a large terminal network.

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Further particulars from The Secretary, The University, Aberdeen, with whom applications (2 copies) should be lodged by 17 November 1978.



## COMPUTER OPPORTUNITIES IN SCOTLAND

OPERATIONS  
DEVELOPMENT  
STAFF

General Accident, Perth, Scotland

The Operations Development Section are responsible for the implementation and support of computer based business systems, including aspects such as the writing of user manuals, design of data input, system testing and the resolution of users' queries over a wide range of insurance applications.

In addition, the section performs a wide variety of support functions on behalf of the Operations Section.

We presently operate an IBM 370/146 under DOS/VS but a substantial upgrade to more sophisticated hardware and software is imminent.

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Computer Services Manager  
North of England Hydro-Electric Board  
Computing and Accounting Centre  
200 Ashgrove Road West  
Aberdeen AB9 2NY

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For an immediate interview telephone Ron McDonald.

ANALYST/  
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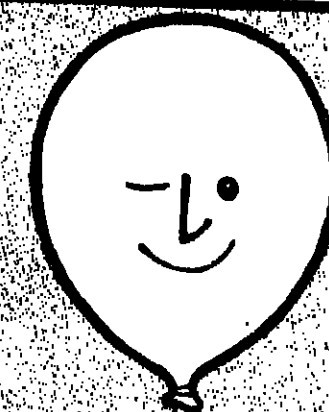
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PROGRAMMERS  
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The closing date for receipt of completed application forms is Wednesday, 8th November, 1978.

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#### PROJECT LEADER

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For an informal discussion on this post, please telephone John Barry on 061-236 9456 Ext. 305.

#### UNIVERSITY OF YORK Department of Computer Science

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#### COMPUTER ENGINEERS U.K. - 0.5

Field / Site / Support  
All systems  
£1,500-£1,800 p.a.  
stand by  
shift  
overtime  
according to post  
or allowance.  
E. S. STACK ASSOCIATES  
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### Mainframe System Software Development

The UNITED KINGDOM ATOMIC ENERGY AUTHORITY'S ESTABLISHMENT at WINFRITH, which is situated between BOURNEMOUTH and WEYMOUTH in DORSET, has vacancies for

## SOFTWARE SPECIALISTS

in the development and maintenance of system software for mainframe computers.

The Establishment is amongst the largest users of computers for research and development programmes in Britain. It has an ICL System 4 mainframe computer on site and a contract has recently been placed to introduce over the next two years a dual ICL 2976 mainframe configuration with 8 M bytes of main store. It is planned to use two attached large minicomputers to communicate with terminal networks on and off site.

Experience in development and maintenance of mainframe system software would be an advantage.

Candidates are normally expected to have good honours degrees in appropriate subjects and suitable post graduate experience, or to have corporate membership of relevant professional institutions. Appointments will be made to the HIGHER or SENIOR SCIENTIFIC OFFICER GRADES.

HSO Salary Range £4,388 - £5,829 p.a.  
SSO Salary Range £5,514 - £7,380 p.a.

Housing assistance under normal Authority arrangements will be available to a married officer living beyond daily travelling distance.

Applications to FREEST. Appointments Officer,  
AEE Winfrith, Dorchester, Dorset, DT2 8DH.

**AEE WINFRITH**

#### UNIVERSITY OF ZAMBIA Applications are invited for the following posts in the Computer Centre

- PROGRAMMER (COMMERCIAL) 3 posts
- SYSTEMS ANALYST FOR FINANCIAL SYSTEMS 1 post

For post (a) a degree or equivalent, and considerable COBOL programming experience. Preference will be given to candidates with ICL experience using the GEORGE II Operating System. For post (b) a degree or equivalent, extensive experience in Programming and Systems Analysis. The appointees will review current systems in the Bureau's Office, determine requirements for development of new systems and also implement them.

Salary scales: Programmer: K4416-5700 p.a. Systems Analyst: K4416-5700 p.a. (ICL sterling - K1:67). The Zambian Government may supplement salaries in ranges K3842-4800 p.a. (sterling) for married appointees and £1650-£2418 p.a. (sterling) for single appointees. The successful candidate will receive a salary advance of 10% and normally travel at all times and provide children a education allowances and holiday visit packages. Detailed job description (2 copies) with curriculum vitae and naming 3 referees to be sent direct to Registrar, University of Zambia, P.O. Box 2279, Lusaka, Zambia, by November 22, 1978. Applicants resident in the UK should send one copy to Inter University Council, 90/91 Tottenham Court Road, London, W1P 0DT. Further details may be obtained from either address.

#### THE UNIVERSITY OF SHEFFIELD M.R.C. SOCIAL AND APPLIED PSYCHOLOGY UNIT

Applications are invited from men and women for the post of

#### COMPUTER OFFICER (Hardware)

to provide design and maintenance support for peripheral equipment connected to the Unit's Modular 11/100 computer system and to carry out a number of administrative and management duties concerning the day-to-day running of the system. Applicants should have experience in the design of electronic equipment, including computer interfaces and be able to write test programs for peripheral equipment. The person appointed will be expected to keep a list of developments in electronic components and techniques and in acquire colleagues on the purchase and use of new equipment. Applicants would normally be expected to have an appropriate qualification in electronics. Salary on the Range 1A scale with Tenable 3 years' experience. Particulars from the Registrar, University of Sheffield, Sheffield S10 2TN. Applications should be sent by 10 November 1978 to the Registrar.

#### SOUTH/MIDLANDS

Programming Team Leaders	PL/1 Fortran prof.	to £8,750	Ref: 127
Systems Analysts	Min. 3 years exp	£7,750	Ref: KBV2
Programmers	2 Languages essential	£7,500	Ref: KBV1
Services Manager	To run Regional Office	£8,000	Ref: KBV4
Senior Programmer	ICL Cobol, George II	£6,000	Ref: 134

**01-231 3459**  
(24 HOURS)

#### NORTHERN VACANCIES

Sales Executives	Computer Services/High basic and car	£10,500	Ref: 128/8
Systems Analyst	ICL 1900 experience	£6,500	Ref: 118
Programmers	Honeywell Cobol	£6,000	Ref: 104
Analyst/Programmers	Assembler with Mini exp	£7,000	Ref: 130
Divisional Manager	Computer Services Company	£7,500	Ref: KBV5
Support Analyst	On-Line IBM system	£6,000	Ref: 114

**051-236 7711**  
(24 HOURS)

## JBA

### Consultant Analyst/Programmers

City £6,500-£9,500 + expenses  
This client is a city-based software house which is continuing to attract development projects from a prestigious and growing client base. On joining their team of Consultants, Analyst Programmers with a good IBM COBOL and/or BAL background will have the opportunity to significantly contribute to the growth and expansion of this still small and versatile organisation. Self-motivation and the capacity for hard work and commitment will be extremely well rewarded, both financially and in terms of increased responsibility and status. Basic salaries range from £5,000 to £8,000 + according to experience, with bonuses and profit sharing providing around £1,500 p.a. extra. Each Consultant has the chance to earn a stake in the company. Contact: Andy Wright

### Systems Analyst

London up to £7,000  
A small but well known British company is about to select its first small business computer and therefore requires a Systems Analyst to define the requirements and select the appropriate equipment. Candidates should have about five years experience in commercial applications, particularly in finance and stock control both as a programmer and analyst. Knowledge of current minis would be an advantage. This position obviously offers the potential for growth to DPM as the installation is set up during next year. Salary according to experience. Excellent opportunity for a professional seeking a challenge. Contact: Jim Baker

### SWITZERLAND

### Systems Analyst/Author

Neg. Swiss salary  
JBA has been exclusively retained to recruit a Systems Analyst with specific communications and real-time experience and who has a proven track record of devising specifications and fully documenting systems. The ideal candidate will have worked recently on telephony or message switching projects thereby possessing an insight into the relevant hardware and, more particularly, the software. Our client offers the security of permanent employment, relocation expenses and attractive salary. Contact: Mike Creamer

For further information on any of the above vacancies please contact the appropriate consultant. If your qualifications do not match the above positions but you are seeking other opportunities please contact us anyway.

**JAMES BAKER ASSOCIATES, International Personnel Consultants**  
16 Maddox Street, London W.1. Tel: 01-491 4478

### Consultant Programmers

Home Counties up to £8,000  
A large well established computer services organisation has opportunities for senior programming professionals to join a team giving advice and assistance to client companies. Applicants must have at least six years experience in a commercial environment, specialising in either software or applications programming. Knowledge of database, communications real-time and programming techniques would be most desirable. These are ideal openings for senior staff with proven records who have reached top positions in their current organisations and are looking for a career in technical consultancy. Excellent salaries and large company benefits. Contact: Jim Baker

### Trainee Product Specialist

South East Herts c£4,500 + profits  
This small but highly successful company now has room for one extra support programmer to join their team. Their business is customizing totally "soft" and extremely powerful micro-based intelligent terminals so once you have proved yourself, a great deal of travel as well as design and programming work will be involved. Backed by a parent company in the USA, their growth has been tremendous, so there is a good deal of scope for individual career development - around £60K + car can be expected within eighteen months to two years. An ideal opportunity for a graduate with about 1 year's experience of Assembler, preferably on minis or micros. Contact: Andy Wright

### AUSTRALIA

Once again JBA proudly announces yet further success in arranging excellent employment for immigrant d.p. professionals down-under. This success is the result of regular guidance and advice during the visa procedures and close liaison with JBA up the point of departure for Australia. JBA therefore welcomes calls from d.p. professionals, with a minimum of 3 years programming and/or analysis experience, who want to find out more about our unique service. Contact: Mike Creamer

## Here is the 8th "X" that scoops the pool — up to £7,000 London

### SYSTEM X — DIVIDENDS GALORE! — SYSTEM X — DIVIDENDS GALORE! — SYSTEM X —

CAREER DEVELOPMENT	X		
UNDERPAID			
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DEAD MENS SHOES			
BEST USE OF YOUR EXPERIENCE	X		
GOOD SALARY	X		
FALLING BEHIND ON NEW TECHNIQUES			
BACKING OF LEADING COMPANY	X		
RE-LOCATION ASSISTANCE	X		
BAD WORKING ENVIRONMENT			
GOOD FRINGE BENEFITS	X		
DOUBTS ABOUT YOUR FUTURE			

### SYSTEMS SOFTWARE PROGRAMMERS & ENGINEERS

AND IF YOU HAVE 2 YEARS OR MORE EXPERIENCE OF HIGH LEVEL LANGUAGES, AND PREFERABLY A DEGREE IN MATHS, SCIENCE, OR ENGINEERING, YOU CAN HAVE YOUR SHARE.

"SYSTEM X", PROBABLY THE MOST IMPORTANT SOFTWARE DEVELOPMENT WITHIN RECENT YEARS, WILL REVOLUTIONISE MODERN TELECOMMUNICATIONS SWITCHING SYSTEMS, AND BACKED BY A MULTI-MILLION POUND INVESTMENT, GIVES THE SOFTWARE ENGINEERS AND PROGRAMMERS CONCERNED IN THE PROJECT A UNIQUE OPPORTUNITY TO KEEP UP TO DATE WITH THE LATEST TELECOMMUNICATIONS IDEAS, AND ALSO MAKE THEIR OWN CONTRIBUTIONS TO FUTURE DEVELOPMENTS.

IF YOU WISH TO BECOME A MEMBER OF AN EXISTING COMPETENT TEAM, OR FEEL YOU HAVE THE ABILITY TO LEAD SUCH A TEAM.

**RING BILL BYRNE ON 01-629 7262 (REVERSE CHARGES)**

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## MYRIAD OPERATIONS

Computer Personnel Consultants

### ICL IN FELTHAM

Working for the computer service organisation of a major U.K. group provides a varied workload, with opportunities to further your career in an interesting environment. Currently an ICL 1903T mainframe handles both batch and on-line processing running under GEORG. \*TAXIMOP. Users throughout the U.K. communicate with the computer via 7020 terminals, and Redifon Seecheck data-preparation systems. The use of advanced hardware-software techniques are under constant review, and a mainframe upgrade is envisaged in the near future.

### PROGRAMMERS To £5,000

A number of substantial projects are underway providing technical design involvement to programmers with a minimum of twelve months ICL COBOL experience. Development projects use COBOL and FTL6, for which full training will be given.

### SENIOR OPERATOR and OPERATOR

£3,200-£5,000

Taking responsibility for the production aspects of the group computer applications means playing an important role in the organisation. As an operator you should have approximately twelve months' GEORG experience and as a senior operator one-and-a-half to two years' gained in a relevant installation. A three-shift system is currently run and future career prospects are first class within the group. Excellent fringe benefits, which include a non-contributory pension scheme, discount on group products and relocation assistance, make these career opportunities truly worthwhile.

Ref. W1/2610

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Please telephone for a confidential  
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01-353 0981

## YORKSHIRE SYSTEMS ANALYSTS AND PROGRAMMERS

£4,500 to £6,500

We would like to talk to experienced COBOL PROGRAMMERS and SYSTEMS ANALYSTS about a number of vacancies with Yorkshire based clients.

The applications under development are wide and varied and the vacancies offer outstanding career opportunities.

Excellent salary and benefits packages will be negotiated, including relocation assistance if appropriate, and will more than adequately reflect the experience, qualifications and potential of the successful candidates.

**NO FORMS: LOCAL/EVENING INTERVIEWS  
DON'T GUESS! 'PHONE IVOR NORTON FOR DETAILS  
PLEASE READ ON**

This advertisement is not intended as a general invitation to register with us - although you may do so if you wish - but relates to specific vacancies which we have been retained to fill by the client companies concerned.

Ivor Norton Management Services Ltd

Recruitment Consulting Division

P.O. Box 63, Copthall Tower House, Harrogate HG1 1TS, Tel. Harrogate 66828

## MANUFACTURING CONTROL SYSTEMS

An exciting challenge for a young

### ANALYST/PROGRAMMER

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Membrain is located in a beautiful part of Dorset, close to Bournemouth and the coast. We are one of the World's leading manufacturers of computer controlled test equipment (A.T.E.) and we place considerable emphasis on maintaining effective production control systems. Our expanding d.p. team now has the requirement for a high potential analyst/programmer. Working as a member of a small team on the development and implementation of our manufacturing control system, you will be using a MINI computer with on-line VDUs. You should have at least 2 years' programming background, preferably including manufacturing and data collection techniques. Experience in systems analysis and mini computers would be an advantage.

In addition to a salary of at least £5,000 per annum we offer all the benefits and career opportunities of a young and growing company. These include a generous pension scheme and relocation allowance as well as a profit sharing bonus.

For more information, telephone Steve Thurlow on Ferndown (0202) 893535 or write with brief details of your qualifications and experience.

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Wimborne  
Dorset



## RE-ADVERTISEMENT

### UNIVERSITY OF EXETER FACULTY OF SOCIAL STUDIES

#### PROGRAMMER III

The Data Processing Unit in the Faculty of Social Studies requires a Programmer III to join a team of four programmers. The Unit has an ICL 4700 computer.

The work is mainly of a statistical nature in the creation and analysis of data banks and preference will be given to applicants with experience of programming in a high level language and the use of statistical packages.

Applicants must have a university degree in a relevant subject but previous computing experience is not necessary as training will be given.

Salary according to qualifications and experience will be within the range £3065-£3504 per annum.

Letters of application stating the names of two referees should be sent to Miss Doreen Watson, University of Exeter by 9 November 1978. Please quote reference No. 8528.

## UNIVERSITY OF LIVERPOOL

### COMPUTER OFFICER

Applications are invited from suitably qualified persons for the post of Computer Officer in the Department of Mechanical Engineering. The department maintains a Computer Laboratory and the Computer Officer is responsible to the department Chairman for running the facilities which comprise a multi-terminal system with disc store and graphics, a research micro-processor and four mini-computers. Duties encompass a wide range of varying areas, including some teaching, advice on programming and software development.

Initial salary within range £3,384-£5,555 per annum. Applications (three copies), together with the names of three referees, should be received not later than 22nd November, 1978, by the Registrar, The University, P.O. Box 147, Liverpool L69 3BB, from whom further particulars may be obtained. Quote Ref. IV/871/CN.

### COMPUTER SCIENTISTS SOFTWARE ENGINEERS

Software Engineers, Sr. Systems Analysts and Sr. Programmers needed to develop real-time systems and/or applications software for many projects including scientific studies, operations research, Management systems, Military research.

Urgent need for person to develop compiler for new high level language.

Urgent need for software eng. with specific knowledge of IBM (MVS). Very long-term freelance consultancy posts outside U.K. at very high remuneration.

Please send detailed resume incl. educational details and phone numbers, to: U.T.S. Systems GmbH, 8 Munich 48, P.O. Box 480922, Frankfurt-Ring 243, W. Germany. Tel: Munich - 3253091.

## South East Thames Regional Health Authority

### Systems Analyst/Programmer

(£5,313-£6,379 incl. London Weighting)

We are looking for someone with a programming background interested in gaining experience in systems analysis to take over responsibility for our developing Manpower Planning system. The successful candidate would report to the Payroll Project Team Leader but would have wide scope for using his own initiative in developing the system.

Hardware consists of 160k ICL 1904S with a communications processor, EDS 60s, fast magnetic tapes, etc.

The Computer Centre is situated in the grounds of Lambeth Hospital close to the Elephant and Castle. It is easily accessible by public transport and free car parking facilities are available.

### Programmer

(£4,775-£5,535 incl. London Weighting)

We require a programmer to join a project team developing on-line systems for Hospital Management. The first phase of a patient registration system has been implemented in one site on a 2904 using T.P.S. software.

This post offers an ideal opportunity for someone with sound COBOL experience to move into on-line programming.

The Project Team is based at King's College Hospital, Denmark Hill, which is easily accessible for public transport and free car parking facilities are available.

For an application form, telephone or write to: Regional Computer Services Officer, South East Thames Regional Health Authority, Regional Computer Centre, Brook Drive, London SE11 4TH. Tel. 01-735 0071 ext. 38.

## Project Leader

### Electronic Point of Sale

#### Systems Development

£6,000+ plus company car

(February review) West London

A leading multiple retail organisation is seeking to appoint a Project Leader to head a major project to investigate and implement a new Electronic Point of Sale system.

The company has been experimenting with and closely monitoring the development of Electronic Till's. They now wish to complete the investigations, emphasising the viability and cost justification of using such a system in their Retail outlets.

As well as the Point of Sale development, the Project Leader will be expected to recommend interim changes to the existing system and monitor and guide any related work study investigation.

Applicants should have a minimum of 4 years' experience of Systems Analysis, preferably in a retail organisation and have implemented at least one major project. Programming experience and the ability to work closely with line management are essential. Experience of Electronic Point of Sale Systems/Equipment and work study/O & M is desirable, though not essential.

The company operates TWO ICL 1900 mainframes which are being enhanced with communication equipment.

Please telephone (01-629 1844 at any time) or write - in confidence - for information. Ref. FY.8386.

**ASL CONFIDENTIAL RECRUITMENT** 17 STRATTON STREET LONDON W1X 8DB  
A member of MSL Group International

## D.P. MANAGER Pathology Laboratory

UP TO £6,000

Ideal applicant with exp. in using ICL 8030 with 2 disc drive, 2 printers and 10 VDU's. Exp. of credit control, sales ledger and report printing.

The position will involve close liaison with laboratory staff in preparation and recording of patients' records, accounts and technical reports.

The position will be located in Harley Street and the usual fringe benefits will apply. Tel: Mr. Braine on (01) 407 7990 for further details.

# 'AT OUR A.G.M. I ANNOUNCED THAT WE NOW HAVE OVER 200 STAFF SHAREHOLDERS'



"CAP-CPP has always placed strong emphasis upon participation in policy issues, personnel considerations and full career opportunities for staff members.

The importance of this involvement coupled with our significant investment in training enables our staff to develop their careers in line with the advances in computing. It is pleasing that so many are now able to share in our success."

**Alex d'Agapeyeff, Chairman CAP-CPP.**

The positions outlined below form a sample of the current openings at each branch. With the wide range of services we offer it is possible for our staff either to remain in a specialist area such as process control or to progress in a broader career direction such as systems analysis leading to management consultancy or project management. We would also like to hear from experienced computer staff who want to join a company where computing is the only interest.

## CONSULTANTS

LONDON AND READING TO £8,250 + BONUS

Providing advice to clients on computer requirements, equipment selection, feasibility studies and installation management. Successful applicants are likely to be experienced Systems Analysts or DPMs with the drive and confidence to advance into consultancy. Ref. No. CW1168

## PROGRAMMERS

LONDON AND READING £4,400 - £6,250

Experience on minis or mainframes in a commercial environment is required. Knowledge of PL/1, RPG2, or COBOL would be of particular interest. Team leading experience would be an advantage. Ref. No. CW1169

## LEADING ANALYST

LONDON TO £8,250

Applicants should have a varied commercial background coupled with the ability to communicate effectively with client management. Project management experience would be a distinct advantage. Typical projects would involve sales accounting payroll, order processing and stock control systems. Ref. No. CW1170

## SENIOR PROGRAMMERS

MANCHESTER/READING TO £6,250

Programmers with small business systems experience especially in a manufacturing environment. IBM System 3/32, ICL 2903, Burroughs B80/800 coupled with team leading experience would be ideal. Ref. No. CW1171

## BASIC SOFTWARE/INDUSTRIAL CONTROL PROGRAMMERS/DESIGNERS

READING TO £6,250

Practical experience of process control applications, communications software, compilers, operating systems is needed. Knowledge of PDPII software and CORAL 66 would be of particular interest. Ref. No. CW1172

## PROJECT LEADERS

LONDON AND READING £8,250 + BONUS

5 or more years experience in commercial or technical projects with at least a year in a project leading role. Suit applicants who have the ability to combine management skills whilst maintaining a keen interest in the technical aspect of computing. Ref. No. CW1173

## ABOUT CAP

Computer Analysts and Programmers was established in 1962 and has been profitable in each of the sixteen years of its operation. We now employ over 700 professional staff advising clients, computer users and manufacturers on a project basis in activities ranging from basic software to industrial control systems to warehousing. The ranges of machines involved cover large mainframes, minis and micros. All staff take part in our well established career development programme and project performances are carefully monitored to ensure that individual skills and aptitudes are taken into consideration on future projects. Benefits include at least 4 weeks holiday, a generous sick pay scheme, group sickness insurance, staff mortgage service, a share purchase scheme and regular salary and promotion reviews. Senior staff are eligible for our annual bonus scheme. Removal assistance is available where appropriate. Local interviews will be arranged where applicable. If you would like to apply please write or telephone, quoting the relevant reference number to:

Tony Knott, Recruitment Manager, Computer Analysts and Programmers (UK) Ltd., CAP House, 14/15 Great James St, London WC1N 3DY. Telephone 01-242 0021.

NAME	
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Computer Appointments, a division of one of the U.K.'s leading recruitment consultancies, is looking to increase its staff by appointing another experienced D.P. consultant. This is due to an ever-increasing demand for our services both here and overseas, and a major increase in both client-paid and company-backed advertising.

Working within an enthusiastic and successful team, you will have plenty of opportunity for complementing your own ideas, and in no way will you be desk bound; in fact client contact will play a considerable part in your weekly routine.

Unlike many of our competitors who operate only in the D.P. world, Computer Appointments can offer successful consultants the opportunity to develop long term career potential not only in management positions but in other recruitment markets and in training; therefore if you are currently successful in D.P. recruitment earning just under £10,000 p.a. and wish to continue — But not until you are 65.

**RING BILL BYRNE ON 01-629 7262 ext. 23**  
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## Computer Appointments

7 Princes Street, London W1R 7HV Tel: 01-629 7262

### UNIVERSITY OF LIVERPOOL ADMINISTRATIVE COMPUTER UNIT SYSTEMS ANALYST/ PROGRAMMER

Applicants should have at least two years' experience in COBOL and some recent involvement in systems design. The present computer is an ICL 1902A, changing to a 2903 during 1979. After conversion the appointed person will be deployed on developing new and enhanced financial systems for the new computer including some on-line applications. Initial salary in range £4,931-£5,288 p.a. according to qualifications and experience, on a scale rising to £6,641 p.a. Application forms are obtainable from The Registrar, The University P.O. Box 147, Liverpool L69 3BX. Quote Ref: RV/879/CW.

### ACTION TECHNICAL COLLEGE LECTURER II IN COMPUTING AND DATA PROCESSING

to join team teaching interesting range of computing courses.

For further details and application form, write or telephone (01-993 2344), Registrar and Clerk to the Governing Body, Action Technical College, High Street, W3 6RD.

## COMPUTER STAFF AGENCY PARTNER

A remarkable opportunity for an experienced agency person to run own business with limited capital (loan repayable out of profits) and to earn what she/he is really worth!

If you are placing 1 or 1½ persons a week you will earn as a partner £20,000 to £30,000 per annum!

Berkley Street Employment Agencies Group  
18 Berkeley Street, Mayfair, W1  
Ring Colin Gray 01-499 5205  
for fullest details

## ITT Controls

ITT Controls is a major German manufacturer and marketer of process computer aided supervisory data centers, and building automation systems as well as burglar alarm systems. We want to secure and increase our market share in the next years. We require as soon as possible for our works in Essen (Germany), the capital of the Ruhr region, engineers for attractive positions in the field of process computer controlled automation and development of electronic circuits.

### Software design Hardware design (Chiffre 623) (Chiffre 624) ENGINEERS

in development, planning, integration, testing and start-up function.

**Tasks:** to design customer specific programs and systems.

**Knowledge:** Programming in assembler and higher programming languages, real-time control systems, basic software programs, data remote transmission.

**Experience in:** Process computer technology with DEC's PDP II family and system generation programming.

The tasks require accepting responsibility and the ability to work independently. Ambitious beginners will be given a reasonable period to familiarize themselves. Knowledge of German would be desired.

Your application. Please, send your resumé together with your curriculum vitae and a photo to our Personnel Department (Mrs. Kettler), indicating the a/m. Chiffre.

**ITT Regelungstechnik, GmbH & Co. OHG**  
Westendhof 8, D-4300 Essen 1

### UNIVERSITY OF LONDON INSTITUTE OF EDUCATION PROGRAMMER A

Applications are invited for the above post in the Department of Science Computing.

The successful applicant will be required to maintain and develop programs to help and advise members of staff engaged in the design and development of computer related subjects, who are interested in a career in scientific and technical information, to join our team of information scientists who carry out the selecting, abstracting, indexing and classification of scientific papers for input to our computerized data base. Applicants may be new graduates or have industrial or other relevant experience. Opportunities exist for specialisation in a particular field of interest.

Starting salaries for new graduates will not be less than £3300 per annum with increments for relevant experience or higher qualification. Full training is given and salaries are reviewed after completion of training (normally 6 months). We offer excellent conditions and flexible working hours in our pleasant new offices at Hitchen, Herts.

Applicants who would like to know more about the possibility of joining INSPEC should write to:

### To £7.6K SYSTEMS ANALYST London EC

International Bank requires two years' experience in bank and experience preferably with an NCR installation and also a programming background. Normal banking jobs.

**£7K PROG. TEAM LEADER London W**  
Graduate with at least 5 years COBOL experience and with management ability for our client's ICL 2970 installation.

**To £8.5K PROGRAMMER Herts**  
Either some FORTRAN and some engineering or specially interactive graphics, or someone with RSX-11M for PDP 11/34 installation with an in-house client.

188 Finchley Road, London NW3 6HP

## Computer and Electronic Scientists as Information Specialists

INSPEC is the leading International Information Service covering Physics, Engineering and Computing and is continuing to expand and develop in this fast-growing field. A wide range of printed and computer-generated services are supported by a strong programme of product development and research into new techniques for information storage, retrieval and dissemination.

We are seeking graduates or equivalent in electronics and computer related subjects, who are interested in a career in scientific and technical information, to join our team of information scientists who carry out the selecting, abstracting, indexing and classification of scientific papers for input to our computerized data base. Applicants may be new graduates or have industrial or other relevant experience. Opportunities exist for specialisation in a particular field of interest.

Starting salaries for new graduates will not be less than £3300 per annum with increments for relevant experience or higher qualification. Full training is given and salaries are reviewed after completion of training (normally 6 months). We offer excellent conditions and flexible working hours in our pleasant new offices at Hitchen, Herts.

Applicants who would like to know more about the possibility of joining INSPEC should write to:

Mr P. Clegg  
The Institution of Electrical Engineers  
Station House, Nightingale Road,  
Hitchin, Hertfordshire SG5 1HJ  
or Telephone: Hitchin (0462) 53331



THE INSTITUTION  
OF ELECTRICAL  
ENGINEERS

## KENT COUNTY COUNCIL

HIGHWAYS AND TRANSPORTATION  
DEPARTMENT  
SOUTH EASTERN ROAD CONSTRUCTION UNIT  
DESIGN STAFF

### Section Engineer

£6080-£8702 (inclusive)

Applicants must have extensive Road and/or Bridge design experience covering approximately five years since graduation. The successful applicant will be in charge of the Computer Applications Section of the Sub Unit.

Particular knowledge of all the latest computer techniques related to Motorways including both roadworks and structural design is essential.

Removal expenses, disturbance allowance and car allowance where applicable.

Application form returnable by 10 November from the Chief Engineer, Kent County Council Sub Unit, SERCU, Concord House, 10/12 London Road, Maidstone, ME16 8QA. Phone (0622) 67881 ext. 32.

For an application form in respect of this and hundreds of other vacancies visit: Niles Via Halliwell, Victoria Appointments Limited, 24 Ashley Square, Manchester 2. Tel: 061 234 7319 (24 Hr. Answering Service) and 061 234 7417 or home 440 2124.

### Houston, Chicago Circa \$25,000 (Ref:31/A)

### London + Regional £6,500 - 8,750 (Ref:31/B)

### Greater London & E.C. U.K. £5,750 - 8,200 E.E.C. £10 - 14,500 (Ref:31/C)

### Home Counties (Herts) £5,750 - 7,750 + benefits (Ref:31/D)

### Central & outer London, E.E.C. U.K. up to £9,500 E.E.C. up to £15,500 (Ref:31/E)

### Operating Systems Designers and Computer writers with any Mini computer background to be based in Oxford area. Salary up to £9,000.

### IBM System 32/34 Analyst Programmers with RPG II for Belgium based client. Financial applications experience required. Salary £12 - 15,000.

### CORAL 66 Systems Designer for 6-9 months Poole based contract. Rate from £265 p.w. PDP-11 background an advantage. Software or technical preferred.

### Micro Processor project & team leaders to join prestige Herts based group launching major new drive in Micro products and software. Salary £6,750 - 8,900.

### Systems Programmer IBM (DOS) for a City of London based insurance company. Preferably some experience of T.P. but solid Assembler is of essence. Salary circa £6,000 plus large company fringe benefits.

### CICS Analyst Programmer O.S. or DOS with either COBOL or Assembler experience. Central London based, salary dependent on experience to £7,200. Financial systems background preferred but not essential.

### Hardware Engineers (Minis) for long term contracts in Germany and France, at circa £400 p.w. (Tax free). A pre-requisite is experience of either 32 or 16 bit Minis or Wangco/CDC type Disk drives.

### Project Leaders & Analysts for Herts and Middlesex based client supplementing ICL 1900 kit with ICL2000 and Minis. Salaries £5,500 - 8,500. Production planning would be an advantage as would distributed processing.

18 months in the United States. Interested? Can you offer 2-5 years IBM or ICL COBOL, alternatively PL/I or Assembler? This prestigious U.S. Multinational corporation has openings in the Mid-West (Chicago) and the Houston/Dallas, Texas areas. After 18 months tour in the U.S. the company will offer you continued permanent employment at their European Headquarters in the U.K. Amongst the many advantages of the plan is the opportunity to develop into Database and Tele-processing (IMS, CICS etc).

PDP-11 programmers with either RSX-11 or RTL-II experience will be very interested in these openings not only for the high salaries being offered but also for the interest element associated with the varied applications being undertaken. A well established U.S. Group of international repute and leaders in their field are seeking motivated and emotionally mature programmers and an Analyst to join their very successful U.K. division. If recognition, job satisfaction and professional autonomy are plus factors to you

Here is a chance to experience the sharp-end of Mini and Micro processor Real-time applications including: Communications, networks, process control, message switching, military systems etc. If you have any Mini Real-time experience using either Assembler, Basic, RTL-II, Coral etc, you will be most welcome as a valued team member. These positions will equally suit candidates with substantial Real-time experience in any of the applications areas mentioned as well as

Unusually attractive positions for 2-4 year COBOL or PL/I programmers for an IBM 370 O.S. installation have arisen due to the setting-up of a newly created and highly motivated young team to be involved in major financial and general commercial systems development projects to replace the present Batch systems. Whilst T.P. and/or Data Base experience would be welcome it is not a pre-requisite. For that reason these positions are particularly appealing to Systems Designers, Analysts and programmers who

Message switching systems at the threshold of today's technology are being developed by an International Publicly owned company — market leaders in their field. Mini and Micro software specialists with or without prior message-switching experience are invited to join one of several development teams in several South East England locations and in three F.F.C. countries. The scale and sophistication of the project being undertaken is the primary aspect of

these positions, salaries too are well above the norm. Matrix have been instructed to aid in the appointment of Project and Team leaders, Systems Designers and Analysts and Programmers, both Senior and Junior. The hardware experience is not particularly relevant but experience at the programming level calls for Assembler or either Coral, RTL-II or Basic. Relocation expenses will be met where applicable and interviews will be held as soon as applications are submitted.

Salaries will by U.S. standards be substantial in the region of \$25,000 p.a. and a full relocation package is available to you and your family. Interviews will be held in London as soon as applications are received and the client is prepared to offer London based positions to candidates whilst Visa processing is underway. These positions will appeal to career minded programmers who till now have not had the chance to sample foreign D.P.

then this company should be ideal. Matrix have been retained to assist in pre-selection of suitable candidates and in that capacity we invite you to phone for a confidential discussion or even better if geography permits call in (no appointment necessary). In any event our client has expressed a willingness to conduct interviews at any time to suit candidates convenience and offers will be made within a maximum of 5 days.

those from a software background wishing to move into applications. Above all these opportunities will appeal to creative and motivated individuals who enjoy working as a team member. Positions include Project Leader, Systems Designer and Programmer vacancies at very realistic salaries with early review and re-grading promised. Please phone or call in at any time for a totally confidential discussion to arrange an early interview with the Client.

until now have been denied the opportunity to experience the sharp-end of Data Processing developments. At the same time those who already possess these skills will command very superior positions from the outset. Salaries are better than average and in many cases well above industry standards. It is hoped that many of the candidates appointed will be able to take up appointments before years' end.

these positions, salaries too are well above the norm. Matrix have been instructed to aid in the appointment of Project and Team leaders, Systems Designers and Analysts and Programmers, both Senior and Junior. The hardware experience is not particularly relevant but experience at the programming level calls for Assembler or either Coral, RTL-II or Basic. Relocation expenses will be met where applicable and interviews will be held as soon as applications are submitted.

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Sales Territories throughout the United Kingdom, including two in the Southern Counties. Base salaries (dependent on starting point) range from £4.5K, with commission rates from 2% to 4% and above in certain circumstances. Benefits including car and expenses, are what one would expect from a progressive British Public Group.

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This manufacturing company with a sophisticated D.P. organisation based on an IBM 370/138 under DOS/VS using CICS for real-time and local teleprocessing systems requires an additional programmer due to

The successful candidate will ideally have 12 months' IBM ASSEMBLER experience, although the company are prepared to train where suitable, and will join their enthusiastic team engaged on commercial and Management Accounting systems.

The Company offers excellent terms and conditions of employment. Assistance with relocation will be available where necessary.

For an application form in respect of this and hundreds of other vacancies visit: Niles Via Halliwell, Victoria Appointments Limited, 24 Ashley Square, Manchester 2. Tel: 061 234 7319 (24 Hr. Answering Service) and 061 234 7417 or home 440 2124.

## West Yorkshire Metropolitan County Council

### Traffic Unit

### Section Engineer

— Post Ref. TF78 917

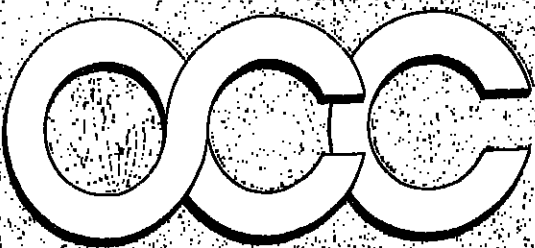
PO1A £5,727-£8,342 inclusive of supplement

To lead a small team undertaking the planning, design and implementation of various parts of the U.K. signal network in the county, initially primarily in Bradford, and such other traffic signal work as is necessary. The post is based in Leeds.

Sound background in traffic engineering essential, particularly in the field of Control Systems and Traffic Signals, together with experience in 'Tansy'. Professional qualification in relevant discipline required.

Application forms may be obtained from Directorate of Planning, Engineering and Transportation, Room 238, County Hall, Wakefield and should be returned not later than 15th November 1978.





## occ computer personnel limited

### Systems Analysts

Central London

c£6,250 + mortgage + bonus

Our client is a major insurance company, who will be replacing their existing machine with an ICL 2960 in 1979. They are expanding the department and wish to recruit analysts with about 18 months' experience, preferably from a programming background, to work on the development of a large, new Central Records System, and to convert existing systems. In addition to the mortgage and bonus, the company offers free lunches, season ticket loans and a full range of sports and social activities. Ref: 747/CW/Jean Alsworth.

### Technical Support

London E.C.1

£5,000-£7,000

An International Computer Manufacturer has recently marketed a new range of small sophisticated business computers which are sold with a complete range of packages.

They wish to expand their support teams to cover the full range of pre- and post-sales support with an emphasis on long-term support responsibility for customer continuity.

In order to be successful candidates should have a systems background on small or medium disc-based machines. They should have good commercial applications experience and some programming.

Ideal candidates should be experienced customer support professionals or analysts keen to move from a user to a marketing environment.

This is an excellent opportunity to join a marketing operation in an exciting stage of expansion. A first class package is offered, a car allowance of £800 p.a., free life assurance, and many other advantages that you would expect from a leading company. Ref: 156/CW/Fran Setter.

To apply for any of the above positions or for further information, please telephone the Consultant concerned during working hours on 01-242 9356, or write to the above address.

If it would be more convenient to telephone in the evening, or at weekends, the telephone numbers are:  
Roger Allington - Berkhamsted (04427) 2299, Marian Tabone - 01-556 5568, Fran Setter - 01-574 6372.

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c£20,000 + benefits

European network: IBM 370s and PDP11s

There is a requirement for a Software Specialist to control the technical planning and support activities for a major manufacturing group. The successful candidate will be appointed at director level and can either be based in Germany or France. The twin centres at the above locations house IBM 370 equipment; and there is a network of DEC PDP11 minicomputers at other main European locations.

The person appointed will, in co-ordination with other directors, be responsible for planning future upgrades and improvements of hardware, software and the telecommunications network. Other duties will include the recruitment and training of technical support staff; and the development of standards and procedures relating to basic software and operating techniques. Knowledge of a European language would be an obvious advantage although the working language is English. Ref: 748/CW/Marian Tabone.

### Computers

S. Germany - PDP. 11 S/Ware Des/Prog  
Holland - PDP. 11 RSX11 commercial  
Yugoslavia - H. 164 GCOS Support  
S. Holland - 1900 - U1100 Conv. COBOL  
Iran - IMS DB/DC Consultancy  
S. Germany - IMS DB/DC Des/Prog  
S. Germany - Mini S/Ware Des. German ess.  
S. Europe - DMS 1100 DB Design

For further details of these and other contracts that we are currently handling, please contact Roger Allington quoting Ref: FL/RA/CW. The majority of contracts are offered with attractive tax-free remuneration packages with durations of between 3 and 12 months.

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### SYSTEMS ANALYST N.W. LONDON

A Customer Support Systems Analyst is required for the type of work involving a new main computer. You must have good commercial experience in the field of design and implementation of systems and software.

### SENIOR SYSTEMS ANALYST HOME COUNTIES

Applicants should have around five years' commercial experience with knowledge of production and financial systems. The position will involve travelling to locations mainly in the Home Counties.

### SYSTEMS ANALYST HARROW

A minimum of two years' systems experience is required for the role of Systems Analyst. The successful candidate will be responsible for the complete reviewing of all systems now operating in the Harrow area of great importance. There will be deep involvement in the feasibility through to implementation.

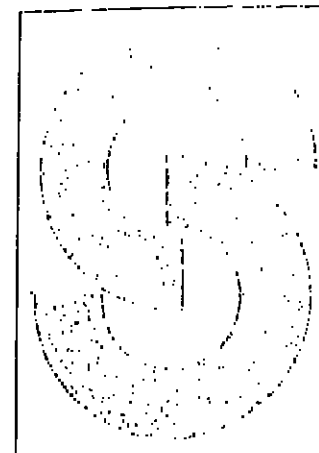
### SYSTEMS ANALYST HAYES

For Analysts with at least 2 years' experience in an operational role in the field of systems analysis, there is an opportunity to join a leading software house in the Hayes area.

Please telephone or call in for more details of our current vacancies and application forms.

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## Will you have designed a system on an IBM 3032 by this time next year?

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Then you can become one of the three Senior Systems Analysts required for a major Distribution and Packed Stock System for several depots and factories. Additional work includes significant enhancements to existing systems, and developing applications for subsidiary group companies.

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We have recently installed a Honeywell Level 64 with 192K Processor and 4 x 100 MB Disks. There are vacancies for **SYSTEMS ANALYSTS AND PROGRAMMERS** who must have a working knowledge of COBOL and be capable of making an immediate impact in our business.

- \* Very competitive salaries
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- \* Good fringe benefits
- \* Substantial job satisfaction.

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The Personnel Manager  
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## SYSTEMS ANALYST - WANTS £7,000 p.a.

Newly-created openings exist within expanding D.P. services division of major British Insurance group. Retaining IBM 370, they seek Systems Analysts, preferably with a good programming background, able to successfully implement medium to large systems and ability to communicate at all levels — to play an important role on their major systems. Co offers

- ★ Good career path.
- ★ Flexi hours.
- ★ Annual bonus.
- ★ Relocation assistance.

Ref 1870

## PROGRAMMERS - S.E. LONDON SALARY RANGE TO £8,000

Our client, based in South East London, provides a wide range of computer services to various professions, and is seeking a programmer to join its development team. This is a fantastic opportunity for FULL TRAINING in BASIC + and RSTS/E. If you have 12 months' experience on any mini or micro computer programming in Basic, Assembler, Fortran, PL/I or assembly type language, telephone NOW. Co offers

- ★ Excellent facilities including active sports and social club and subsidised restaurant.
- ★ Profit share scheme.
- ★ First-class promotional prospects.
- ★ TRAINING ON BASIC + and RSTS/E.

Ref 1885

## FOR PROGRAMMERS - CITY £7,000 p.a.

An exciting opportunity for ICL COBOL programmers with proven track record to move into challenging and rewarding role. The company is a prestige British banking organisation currently retaining ICL 1900 but with a 2860 scheduled for delivery mid-1979. The position will initially be involved in the continuing development of an existing commercial project to be followed by all new development work on 2860. Co offers

- ★ SUBSIDISED MORTGAGE
- ★ 32 1/2 hour week.
- ★ Non-contributory pension, free BUPA, and life assurance. Season ticket loan, 60p LV daily.

Ref 1895

## FOR PROGRAMMERS - CITY £7,000 p.a.

Our client, leading bankers, require programmer with at least 18 months' experience in RPG/II. Applicant will join a young and enthusiastic data processing team which retains IBM system 3 hardware. Major enhancements are planned to keep pace with company's rapid growth. Applications will be of financial nature and company offers good promotion prospects.

- ★ EXCELLENT fringe benefits which include banking and credit facilities, profit share and non-contributory life assurance and pension scheme and BONUS.

Ref 1828

## JUNIOR SYSTEMS ANALYST - LONDON To £6,500 - 4- SUB MORTGAGE

Major British Insurance company with assets exceeding £440m seeks persons with minimum 12 months' experience of systems analysis and design covering major aspects of systems work, preferably with an ICL COBOL programming background. Company has well planned future including delivery of ICL 2860 next year running under VME/B and covering projected development work. Co offers

- ★ Excellent early promotional prospects.
- ★ Full 2900 training.
- ★ FANTASTIC perks which include FLEXI HOURS, season ticket loan, FREE LUNCH, BONUS and annual review

Ref 1849

## PROGRAMMERS - S.E. HOME COUNTIES TO £6,500

Super opportunity exists within multi-national communications conglomerate for a programmer working on a team developing major message-switch system. Ideal applicant will have PDP experience under RSX programming in MACRO/II, however company will accept 2 years' experience on ANY MINI ASSEMBLER. Co offers

- ★ First-class career structure.
- ★ Training on sophisticated software.
- ★ Training on RSX/II.
- ★ Unlimited scope for advancement.

Ref. B134

## SYSTEMS ANALYST M. LONDON - £8,000

Prestige organisation providing services to British banking industry requires Systems Analyst to become involved in the implementation and continuing development of large on-line communication system. Ideal candidates should have programming background, experience of working in operating system environment with T.P. bias and able to play a major role in the design and implementation of an on-line transaction processing system. Experience of ICL hardware an advantage. Co offers

- ★ Mortgage subsidy.
- ★ Non-contributory pension scheme.
- ★ Personal loan scheme.
- ★ RELOCATION EXPENSES

Ref 1868

## ANALYST - LONDON - £7,000 p.a.

Long established bank is seeking to recruit experienced COBOL programmer to join team shortly to embark on a complete re-write of its accounting system following a review of its hardware requirement which will lead to the acquisition of a sophisticated mini computer system. Successful applicant should have 2/3 years' experience of COBOL in financial area, with NEAT 3 a great asset. Co offers

- ★ Mortgage assistance
- ★ BUPA
- ★ LV £4 per week
- ★ Non-contributory pensions and life assurance

Ref 1847

## JUNIOR PROGRAMMERS - CITY TO £5,500

Major group engaged throughout the world in a variety of industries has additional programming positions at their large IBM 370 City installation. Applicants should have 18 months' commercial experience of PL/I, COBOL or ASSEMBLER languages with IMS Database and CICS — a distinct asset, a willingness to tackle a variety of problems and ability to grasp quickly the concept of the business. Co offers

- ★ Training on database and T.P.
- ★ Attractive salaries and fringe benefits including ANNUAL BONUS and free staff restaurant.

Ref. 1840

## LEAD SYSTEMS ANALYST SURREY. TO £7,500

World-wide leading manufacturer of sophisticated industrial products retaining IBM 370, currently requires a head Systems Analyst for major commercial system running under CICS and PL/I. Prospective candidates should be self-motivated, with feasibility, design and implementation experience.

- ★ Possible travel to Europe.
- ★ Very impressive company with offices located in beautiful ground.
- ★ Excellent sports and social club.

Ref. 1899

## SYSTEMS PROGRAMMER W. LONDON/BEDS. TO £6,750

International group of companies with outstanding reputation for efficiency, growth and investment seeks a systems programmer to undertake full systems responsibility of their IBM 370 hardware. Applicants will have good technical backgrounds with at least 2 years' ASSEMBLER running under DOS. This is an excellent opportunity to join the organisation at a senior level.

- ★ First-class company, benefits which include non-contributory pension, life assurance and sickness scheme.
- ★ RELOCATION ASSISTANCE if required.

Ref. 1896

## ANALYST - LONDON - £7,000 p.a.

Our client, one of the world's leading suppliers of high technology products and services to world wide energy and industrial markets, are seeking a trainee analyst programmer. If you have 12 months' COMMERCIAL COBOL programming experience this is a fantastic opportunity to be trained in analysis. They have a large LP network with links to Europe and they offer full training in database and T.P. Co offers

- ★ Fantastic job opportunities
- ★ Excellent prospects for promotion
- ★ TRAINING in ANALYSIS, T.P. and DATABASE

Ref. 1802

For further details telephone our London Office 01-734 0152 (24 hours)

# CONTRACT DIVISION

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IBM OS/400 AN/PROG  
IBM COBOL/ASSEMBLER DOS.  
IBM ASSEM/PL/I DOS AN/PROG  
IMS COBOL OR ASSEM OS AN/PROG  
IBM OS + SO COBOL AN/PROG  
DATAPOINT 2200 EXP.  
PDP MACRO II RSX/II  
IBM DOS VS ASSEM + COBOL  
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PDP DIBOL  
IBM SYS/AN MIN EXP PREF  
IMS COBOL ANALYSTS & PROGS.

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IBM SERIES I ASSEMBLER  
PDP MACRO II RSX/II  
IBM OS COBOL S.P.S.S.  
IBM SYSTEMS PROGS OS/DOS  
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For details of the above and future contracts ring CHRISTINE KEY or DAVE HAYTON. Tel. 734-0152 (24 hours).  
27 Noel Street, London, W.1.

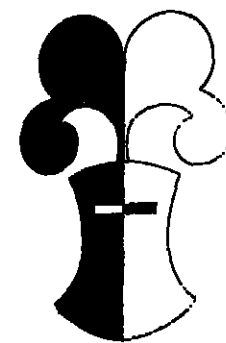
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# KNIGHT PROGRAMMING SUPPORT LIMITED



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HONEYWELL L66 IDS/TDS  
IBM 370 PL/1 PROGRAMMERS  
HONEYWELL L66 GCOS COBOL  
IMS SYSTEMS ANALYST  
IBM COBOL OS PROGRAMMERS  
SYSTEMS ANALYST FINANCIAL  
SYSTEM 10 ASSEMBLER

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£250 NORTHWEST  
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£200 SCOTLAND

PDP RSX/II PROGRAMMERS  
REALTIME PROGRAMMERS  
IBM 370 PL/1 PROGRAMMERS  
HONEYWELL L66 GCOS COBOL  
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DATABASE DESIGNERS  
PDP DIBOL PROGRAMMERS

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£220 BRISTOL  
£225 NORTHWEST  
£220 SCOTLAND  
£245 NORTHWEST  
£220 NORTHWEST

FOR DETAILS OF THESE AND OTHER CONTRACTS, PLEASE CONTACT PERRY BUTLER

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## Scheduler

This position offers experience of a wide range of applications and duties involving the preparation of daily computer schedules, liaison with user departments and provision of advance schedules.

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The installation comprises a 2MB 370/148, supporting teleprocessing, R.J.E. time sharing and batch. The main operating system is VM/370 - DOS/VS, POWER/VS.

The position offers a competitive salary, plus productivity payments and general conditions of employment are excellent. Additional benefits include canteen meals at token prices, discounts on Company products and Sports and Social Club facilities.

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#### SYSTEMS PROGRAMMER

Grade: A.P.5/S.O.1 £4773-£5568 p.a. including supplements

Applications are invited for the above post which is one of three such posts in the systems development team of seventeen who are developing new computer applications and maintaining existing systems for the City Council's computer which is at present an ICL 1901T.

The duties of the post include the design of computer systems and program suites to meet user requirements as specified by Systems Analysts, the production of computer programs, the co-ordination of the systems and programming functions of small project teams and the implementation of modifications to existing computer systems.

Candidates should possess three years' programming experience, a good knowledge of ICL 1900 series software, the ability to devise programming strategies and the ability to communicate effectively with users. A working knowledge of PLAN and of teleprocessing techniques is also desirable.

Post Reference: 1521/CW.

This post is permanent, superannuable and subject to the satisfactory completion of a medical questionnaire. Commencing salary will reflect experience and qualifications. Please write or telephone 061-783 3155 for an application form quoting post reference number to the Personnel Manager, Salford Civic Centre, Swinton M27 2BN, to whom they should be returned by 10th November, 1978.

## PROGRAMMER/ANALYST

£4017-£4431 inclusive

## Computer Operator

£3,895-£4,419 p.a.  
including shift allowance

A vacancy exists in the computer operations section for an Operator, male or female. There are two shifts covering a working day of 08.30 to 24.00 hours.

The installation which is currently expanding, runs on IBM 370/135 192K with DOS/VS, Shadow II, QUOTA II. There is a mixture of disc (3340/3344) and tape.

Preference will be given to applicants with a sound technical background and an in-depth knowledge of JCL is essential. Application forms from Controller of Financial Services, London Borough of Harrow, P.O. Box 21, Civic Centre, Harrow, Middlesex HA1 2UJ, quoting reference CW/E37, returnable within 14 days of the appearance of this advertisement.

Harrow Finance

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ICL	GH	OP/SFT LDR	1YR +	£5500	SURREY
ICL	ANY	OP/SFT LDR	1YR +	£6000c	MIDD
ICL	GH	OPERATORS	1YR +	£4800c	W. LONDON
ICL	GH	OP/SNR OP	2YR +	£4300 +	C. LONDON
UNIVAC	ANY	OPERATORS	1YR +	£4500	W. LONDON
NCR	ANY	OPERATORS	1YR +	£4200	E. LONDON
DEC	PDP	OPERATORS	1YR +	£4300	C. LONDON
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Ref. N1/2610

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We are seeking an applications programmer with at least two years' experience, preferably in PL1, to join our systems programming team. A knowledge of VM/370, OS/VS1, OS/MVS or Assembler would be an advantage, but full training will be given where necessary.

You would be part of the Group Management Services organisation at our headquarters in York, and work in purpose built offices, on the northern fringe of the City. House prices are still reasonable and help with removal expenses may be given. Salary will depend on age and experience. In addition, we run profit sharing, sick pay, pension and life assurance schemes.

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The successful candidate will head up a team of software engineers and programmers who will design, write, de-bug, and integrate the real time software for a component part of a major communications programme which by its very nature will lay down the standards for the future development of the micro-electronics industry in the 1980s.

Ideally, applicants should have 3 years' experience in this field, preferably using high level languages, and whilst previous supervisory experience would be useful it is by no means essential for the right candidate.

The company has a highly competitive salary package with many useful fringe benefits, also full relocation will be offered where applicable.

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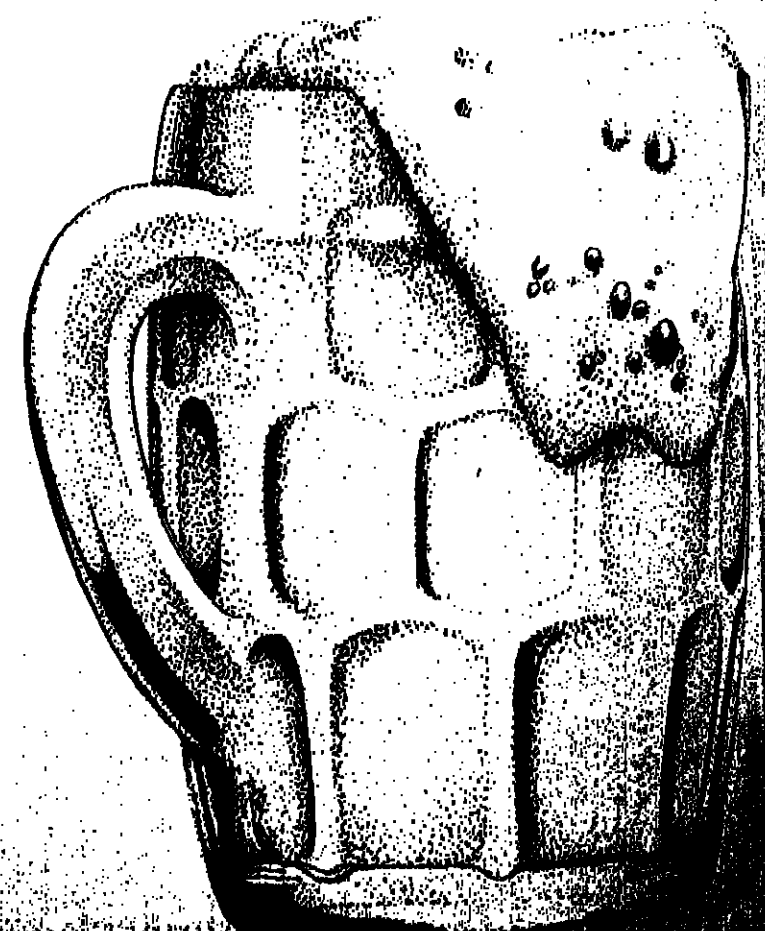
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If you can't make it but would like to know more about Square One, just Barbara Hawkins on Chesham 332

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## CICS SYSTEMS PROGRAMMER

c £7,500

## PROGRAMMERS to be ANALYST/PROGRAMMERS to £6,000

SOUTH BEDS.

## SYSTEMS PROGRAMMER:

This is a **GOLDEN** opportunity for a CICS Systems Programmer to move into a challenging position. The Company has just upgraded to a new IBM 370/138 operating under DOS/VS, release 34. You will be responsible for writing all the Software and monitoring the machine's performance.

## ANALYST/PROGRAMMERS

We are looking for Analyst/Programmers or Programmers who are capable of becoming Analyst/Programmers. You will liaise with users, obtain their requirements and see the system through to implementation. You should be able to program in PL/1 or Cobol. Initially you will be part of a team working on Accounting and Manufacturing systems.

Our Client is a profitable Manufacturing Company. They are part of a major British Group located in South Beds. and RELOCATION expenses will be paid if required.

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To apply please contact Mr. P. Ward, Crown House, Heath, Bushey, Herts, London TW20 7UH. Tel: 01 953 9957.

## SYSTEMS ANALYSTS

City

to £7000

A major finance company based in the City wishes to recruit additional staff to work on the development of new projects for their expanding IBM 370 system.

The individuals they are seeking will have a minimum of two years Analysis and must have implemented at least one major system. Any knowledge of CICS or PL1 would be a distinct advantage.

In addition to a highly competitive starting salary the company offers an attractive benefits package and excellent working conditions.

Reference JC 43/1

## PL1 PROGRAMMERS

City

CE5750

One of Europe's foremost companies and a market leader in the Transport and Distribution Industry is in the process of expanding its 370 installation and upgrading the Operating System from DOS/VS to OS/MVS.

In order to ensure that the transition is as smooth as possible they wish to recruit talented programmers with at least one year's PL1 experience. A commercial background with Database or Real Time applications would be advantageous as would a knowledge of OS/MVS.

A first class salary is coupled with excellent career prospects and fringe benefits.

Reference JC 43/2

## OPERATORS

Junior and senior operators with 6 months plus experience on IBM, ICL, NCR, Honeywell, Burroughs, DEC and PDP are required urgently. Below is a small selection of our current vacancies: - if you don't see one to suit you call us to find out about the many others available.

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**IBM 370 DOS** Shift leader with 3 yrs + exp. for N. London travel Co. Perks include very cheap holidays. £5000

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**ICL 1900 GII** 18 mths + experience for C. London site. Limited nights, chance to learn new hardware. £4400

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**ICL 2900** 1900 ops. with 6 mths exp. to retrain on large 2900. £3300

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**NCR 100/75** 18 months experience required for Essex site with no nights. £4200

**UNIVAC 1108** Minimum of 2 years experience required for major manufacturing company. Excellent career path. £4500

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Rural

Nottinghamshire

from £4,750

Our client, a well known Midlands company uses a small mini-computer to significant effect in the day to day control of the business.

Further extension of the use of the computer, probably involving the installation of enhanced hardware, provide an interesting opportunity for a young accomplished programmer. Some experience of BASIC although not essential would be advantageous as would some limited analysis experience.

The successful candidate will report directly to the Financial Controller and will have ample opportunity to increase their responsibility and undertake a more responsible/management type role.

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Reference HK 43/3

## JUNIOR FORTRAN PROGRAMMERS

West London

to CE4500

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Training in Systems Analysis will be provided and exposure to mainframes (an IBM 370/138), mini computers (on Prime 300's) and micro machines, will all ensure a wide range of experience and a 1st class choice of career prospects in the future.

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Reference HK 43/4

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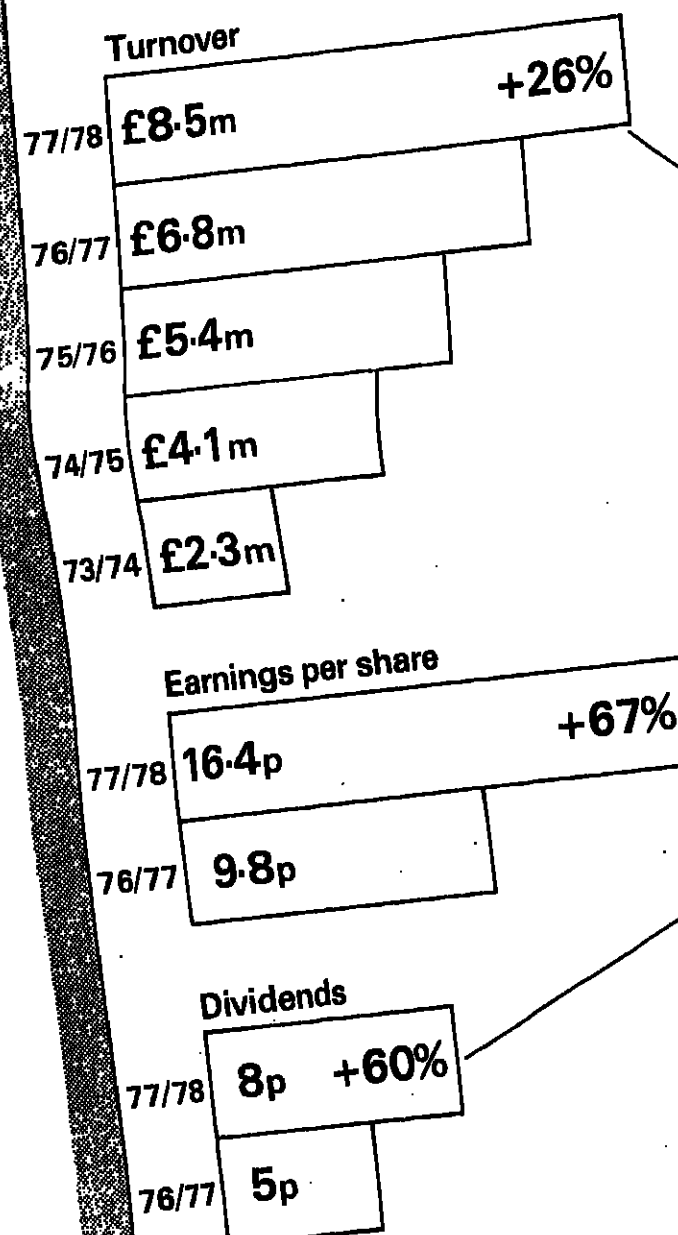
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# Analysts/ Programmers

Financial Times 28 September

## CMG 1977/1978



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SCHOOL CAREER

EXAMINATION RESULTS (subjects and dates)

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### CAREER HISTORY

PRESENT OR MOST RECENT EMPLOYMENT

NAME OF COMPANY

JOINING DATE

JOINING SALARY £

CURRENT SALARY £

POSITIONS HELD (approx. dates) and DUTIES SPECIFYING COMPUTERS USED AND AREAS OF BUSINESS KNOWLEDGE:

PREVIOUS EMPLOYMENT

NAME OF COMPANY

JOINING DATE

JOINING SALARY £

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POSITIONS HELD (approx. dates) and DUTIES SPECIFYING COMPUTERS USED AND AREAS OF BUSINESS KNOWLEDGE:

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NAME OF COMPANY

JOINING DATE

JOINING SALARY £

CURRENT SALARY £

POSITIONS HELD (approx. dates) and DUTIES SPECIFYING COMPUTERS USED AND AREAS OF BUSINESS KNOWLEDGE:

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ANYTHING ELSE YOU WOULD LIKE TO ADD:

SIGNATURE

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# Software Design Assurance

## System X

n. Complex whole, set of connected things or parts arranged to work together

x (eks), first unknown quantity

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Prospects within the Software

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Please call Bill Carr, Personnel Officer, on Maidenhead (0628) 2351, or write to him at: Plessey Telecommunications Research Limited, Taplow Court, Taplow, Maidenhead, Berks.



## Applications Programmers

The Polytechnic currently runs a 96K ICL 1903A under the George 3 operating system. This will be replaced next year by a large dual PRIME 500 interactive system, initially supporting up to 64 terminals installed at a number of locations.

We are expanding the programming section to deal with the micro- and mini-computer applications which will arise with the new system. Applicants should have a sound programming background and experience in the use of certain major applications packages, (eg. GINO-F, SPSS, NAG, PAFED) would be desirable, though not essential.

Salary scale £3,732-£5,073 p.a.

Assistance with removal expenses will be given in the appropriate cases.

Further details and application form from the Staffing Officer, The Polytechnic, Wolverhampton WV1 1L. Tel. Wolverhampton 27371.

## Senior Computer Operator

up to £4971 per annum including shift allowance

A vacancy exists in the computer operations section for a Senior Operator, male or female. There are two shifts covering a working day of 08.30-24.00 hours. The Senior Operator acts as a shift leader and applicants should therefore be fully experienced operators.

The installation, which is currently expanding, runs on IBM 370/135 192K with DOS/VS, Shadow II QJ07A II. There is a mixture of disc (3340/3344) and tape.

The commencing salary will be determined by the experience of the successful candidate.

Application forms from Controller of Financial Services, London Borough of Harrow, P.O. Box 21, Civic Centre, Harrow, Middx. HA1 2JL, quoting reference CW/F37, returnable within fourteen days.

**Harrow**

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## Applications Development

### Applications Development Manager — at least £7329

Applicants should have considerable experience in the development of major applications with proven success in project management.

### Applications Team Managers — at least £6798

Applicants should have considerable experience in the development of major applications together with management experience.

### Applications Analysts — at least £6012

Applicants should have experience in producing system specification for major applications.

### Applications Designer/Programmers — up to £5517

Salary dependent on experience. We have vacancies for experienced programmers at all levels.

## Technical Support

### System Support Manager — at least £6798

Applicants should have considerable experience of the technical support function, including at least a year at team leader level.

### System Support Analysts — at least £6012

Applicants should be senior programmers with experience of supporting a large operating system, software utilities and packages.

### Support Analyst/Programmer — up to £5517

Salary dependent on experience. Applicants should have at least 2 years programming experience including a working knowledge of George 2.

## Operations

### Assistant Operations Manager — at least £5517

Applicants should have considerable operating experience using a large operating system together with some experience of general operations management.

### Operations Team Leader (Day Shift) — at least £6059

+ shift allowance. At least three years 1900 or 2900 operations experience including some supervisory experience.

If you would like to know more, just telephone 278 8753 extension 33 (24 hours) or write to the Head of Computer Services, London Borough of Newham, 51 The Green, London E15 1EW, and we will send you a prospectus giving details of our organisation and the post or posts in which you are interested.



## OPERATORS

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### SENIOR SYSTEMS ANALYST

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A graduate is required to lead a team whose responsibility it will be to develop and implement projects on manufacturing systems. It is therefore necessary that the successful applicant will have strong communicative skills, on-line experience preferably gained in a Mainframe environment and has implemented at least one major project. Personal career development prospects are excellent.

### PROGRAMMER

to £5000 + Benefits

An experienced Cobol programmer is required to implement Production Control and Materials Management Systems. The Company is based North of Manchester and utilises minis and RJE terminals to a 370/158. There are opportunities for advancement both locally and nationally. Benefits include substantial discount on the Company's products and a subsidised Staff Restaurant.

### SYSTEMS ANALYST

circa £5500 + Co. car

A Systems Analyst is required to control a small team in the enhancement of existing systems and to develop them so that they are able to meet future requirements, particularly in the area of on-line Stock Control. Programming experience is not essential and the usual large Company benefits are applicable including RELOCATION assistance where necessary.

### COBOL PROGRAMMER

from £4000 p.a.

Our clients are a company within the service industry and wish to recruit a Cobol programmer to augment their existing team so that their plans to enhance their twin 2804s and communications network can be put into operation. This position offers above average prospects for the successful applicant who is ambitious and career minded.

For further details of the above positions and others ring 061-832 5856 or write enclosing C.V. to: ATA Computer Recruitment, Anglia House, 88 Cross Street, Manchester M2 4LA.

LONDON (01) 637 0781  
230 GL Portland St W1N 5HG

MANCHESTER (061) 832 5856  
88 Cross St. M2 4LA

BIRMINGHAM (021) 643 1964  
Woodworth Building, 102 New St.  
B2 4ND

BRISTOL (0272) 211035  
Equity and Law Building  
36/38 Baldwin St. BS1 1NR

EDINBURGH (031) 226 5381  
Anglia House, 24/26 Fife Street  
EH2 2JH

DRAWLEY (0293) 514071  
36 The Broadway

## WEST COUNTRY

### 370 DOS/VS OPERATOR

BRISTOL

Salary very negotiable

As a large well-established national company in the food industry, our client enjoys diverse product manufacture and recognised market leadership.

Their D.P. facility is based in Bristol and consists of a 1/4 Megabyte 370/135 (which is to be upgraded to 1/2 Megabyte within the next few weeks), 3 x 3410/11s, 6 x 3340s, 1 x 2601, 1 x 1403 plus T.P. network of over 20 VDU/printers.

They are committed to major hardware expansion both in-house and in other group companies which necessitates the recruitment of an additional operator with at least 12 months' experience in a 370 environment using DOS/VS and POWER.

Their real-time system is currently run under CICS but it is being replaced with a SHADOW TP Monitor, so experience of either would be an advantage.

A 3-shift x 5-day system is worked with a 36% shift allowance giving a total package which will exceed the successful candidate's present salary.

Fringe benefits include generous relocation assistance where necessary, subsidised staff canteen and substantial discounts on the company's products.

For further information telephone our Bristol Office 0272 211035 or write enclosing detailed curriculum vitae to:

ATA Computer Recruitment, Equity & Law Building, 36/38 Baldwin Street, Bristol BS1 1NR.



# COBOL PROGRAMMERS



## We'll be really glad to see you

North Thames Gas is developing a Customer Service computer system to achieve a further improvement in the standard of service to our customers. We attach great importance to this project, and the people who make it a working reality will be highly valued. It is a real-time system running on Data General C330 minicomputers, with over 60 V.D.U.s and we are now looking for COBOL PROGRAMMERS.

For the junior posts, you will need to have at least 1 year's successful COBOL experience, and for the more senior posts at least 2-3 years' experience.

As part of a small development team you will be responsible for the design, coding and testing of new programs.

### The Benefits

The Development Centre for this system is in a pleasant building in Acton, West London, easily accessible by most forms of transport, and has free car parking nearby.

The salary range is £4227 to £6012 and starting salaries will depend on experience. The many additional benefits include 25 days holiday entitlement, a first-rate social club and sports facilities which include squash courts, tennis and football.

This could be a very positive step forward in your career.

*We would be really glad to hear from you.* Make the first move by telephoning Richard Toombes, Systems Manager, Minicomputers, on 01-993 0914, for an exploratory talk; or ask our Recruitment and Selection Officer on Staines (81) 61666, extension 3282 for an application form; alternatively write to him in sufficient detail to make an application form unnecessary at: North Thames Gas, North Thames House, London Road, Staines, Middlesex TW18 4AE.

## NORTH THAMES GAS

## Factory Data Collection System Consultants

Feltham  
Middlesex

£6000+

Join our expanding activities in factory data collection systems. ICL are totally committed to factory data collection systems and are in the forefront of their development and application.

You will be involved in the development and product introduction of new and enhanced products that will take us far ahead of our competitors. Our understanding of customers' industrial requirements is of prime importance and we will expect you to have achieved proven technical success in the development or implementation of factory data collection terminal systems.

You should be familiar with both the equipment and language aspects of small systems processors, ideally System Ten or 1500, and with their industrial application. This will enable you to ensure the successful early implementation of the new DCSS products for our customers around the world. You will be based in Feltham, Middlesex, with extensive travel to other ICL premises and customers in the UK, and with some travel abroad.

If you have the experience we require and can play a significant role in these exciting developments you could start on a salary in excess of £6000. Relocation assistance will be given in appropriate cases. For further information please contact Terry Fuller or Julian Oliver at Small Systems, Central Systems and Technical Support Division, ICL, Forest Road, Feltham, Middlesex, Tel: 01-890 1414, ext. 987. Please quote reference CW1000.

International Computers

think computers - think ICL



## University of Birmingham

### COMPUTER CENTRE Adviser for Interactive Computing

The Centre's provision of a wide range of local and remote computing facilities is now being extended by the installation of a large DEC 2050, serving 80 terminals which will provide a dedicated interactive system for both teaching and research.

A new post of Computer Officer has been created in the User Services Group to develop the practical application of

CAI and CAL techniques.

The post is tenable for two years, secondment would be welcome.

Applications are invited from graduates with computing experience, especially in the areas of simulation and modelling techniques. A higher degree is desirable, but clear evidence of previous work successfully completed is equally important.

Starting salary, according to age, qualifications and experience, will be on the scale £3,384-£5,604 (Bar) £5,565 (under review)

Further information from the Assistant Registrar, Science and Engineering, University of Birmingham, P.O. Box 363, Birmingham B15 2TT, to whom applications (three copies), including full curriculum vitae and naming three referees, should be sent by Friday, 10th November, 1978.

Please quote reference C28



## City of Sheffield

City Treasury  
Computer Services Division

Applications are invited for the following vacancies which arise as a result of internal promotions:

### SYSTEMS ANALYST

AP5/SC11-£4773-£5568 (including supplement)

At least 12 months' systems experience would be an advantage.

### PROGRAMMER

T4/5-£4245-£5073 (including supplement)

Experience of COBOL programming (not necessarily only 1960s) are required.

### JUNIOR

### PROGRAMMER

T1/3-£1656-£4146 (including supplement)

Consideration will be given to inexperienced programmers and to applicants without computer experience but who show an aptitude for and are enthusiastically interested in a career in computing.

The installation consists of an ICL 1904S (192 K core) operating under Geopics 3. A wide range of interesting applications have been developed, including communications facilities (two 7502 systems are in use), and the successful applicants for the above posts will participate in extending this wide range.

Applications stating age, qualifications, experience and training details, together with the names of two referees (one of whom should preferably be his/her current employer) to the Chief Personnel Officer, Town Hall, Sheffield S1 2HT, by 7th November.

## PROGRAMMER / ANALYST

Start salary up to £5,043 (plus major fringe benefits).

Applications are invited from mature and capable people with at least 2 years NEAT/3 programming experience to join our Data Processing Department.

The Society will be replacing its NCR CENTURY 75 with an NCR CRITERION N8450 in the very near future and plans to develop an on line communications network to initially supplement and eventually replace its batch processing environment.

An exciting career is offered to applicants prepared to work on their own initiative and accept the responsibility that the position demands. An attractive salary structure (to be reviewed 1st January, 1979), concessionary mortgage facilities and free membership of BUPA are amongst the benefits provided.

In the first instance applicants should write giving details of educational background, career history and current salary to



BIRMINGHAM BUILDING SOCIETY

Computer Services Manager  
(Staff Appointment)  
Birmingham Building Society  
42-44 Waterloo Street  
Birmingham B2 5BP

# DP PEOPLE!

## BIG MONEY?

LOOKING FOR

IF YOUR EXPERIENCE IN THE DP INDUSTRY IS:

LIMITED

SUPERVISORY

CONSIDERABLE

MANAGERIAL

There is a wide selection of locations waiting for you here and now!

### JUNIOR PROGRAMMERS

£3,000 to £4,300

S.E. ENGLAND

You have only one year's commercial experience? Then you are in great demand. We have a large selection of first-rate companies who need people like you. Some offer mortgage assistance to the right candidates after short period with them. CW 43/1

### PROGRAMMERS AND ANALYST PROGRAMMERS

£3,900 to £7,400

LONDON, HOME COUNTIES AND MANCHESTER

We are inundated with COBOL, ASSEMBLER and PL/1 vacancies. If you have more than one year's experience, why not ring now for a confidential chat? After 8 years in the business we really know the market place. CW 43/2

### PROGRAMMERS

c £5,500

WEST LONDON

Two with-it COBOL programmers with two years' or more experience are required urgently by a top advertising agency having the latest Hewlett Packard large mini-computer installed. Lots of interesting new work. Top perks and posh offices. CW 43/3

### OPERATORS

To £4,400 inc.

NR. HOUNSLOW

A major Service Bureau with international clients requires ICL GII or GIII operators who have experience of large machines. Perks include 21 days' hols., flexitime, C.P.S. and a good chance for promotion. CW 43/4

### PROJECT LEADER - BANK

£8,000

S.E. LONDON

A small but famous International Bank requires a mature applicant to take charge of a small team dealing with banking systems, re-Payment Transfer and Foreign Exchange, so DEC RSXII and supervisory experience is a must. Perks are excellent, including free meals and low rate mortgage payments. CW 43/5

### FREELANCE PROGRAMMERS

To £360 p.w.

ICL COBOL VME/B  
ICL COBOL GIII  
ICL Sys. /4 Usercode  
ICL Systems Analyst  
ICL 2804 An./Prog.

Luxembourg  
City  
Liverpool  
S.W. London  
Bank in Nigeria

6 months  
6 months  
3 months +  
3 months  
6 months

Apply NOW for the latest vacancies, IBM, HONEYWELL, DEC & ICL programmers welcome. Earn a Xmas holiday paid break plus an attendance BONUS. Ask for the Contracts Officer on 01-995 4148. Irene.

### MINI COMPUTER PROGRAMMERS

£4,000 to £8,250

LONDON & HOME COUNTIES

If you have experience in ASSEMBLER or micro-code or communications for at least 1 1/2 years then a whole exciting field is open to you. We now have opportunities in S.W., N.W. or W. London, Surrey, Berks. and Hertfordshire for competent people in this rewarding field. The future is definitely going to be with the MINI-Computer professional. Telephone for details. CW 43/6

To further your career try UGA the big name for Permanent & Contract Staff since 1968. For big money and fresh surroundings contact Michael Pepper on 01-995 3883/01-958 6138 (evenings)

UNIVERSAL COMPUTER ASSOCIATES LTD.  
Data Express House  
3 Prospect Place  
Hatchford Lane  
Chiswick W5





## SHADOW II PERSONNEL

Rendek is a medium-sized international software house with offices in the Netherlands, England and the U.S.A. Our group of companies work in various fields and aspects of the computer industry with the main emphasis on database and data communications projects, and owing to our marketing of Shadow II in the Benelux countries, the majority of our teleprocessing work is concerned with Shadow.

We require Cobol programmers and analysts with at least one year's experience with Shadow to join our companies as part of our planned expansion for early 1979. Successful applicants will work in one of our teams on projects in the Netherlands or in the U.S.A., where salaries, expenses and benefits will be well above average.

Initial interviews will be held in London throughout October.

Please write with personal details or telephone for an application form, when a mutual appointment can be arranged, to our London or Amsterdam office.

Bridget Kitchie  
**RENDECK LIMITED**  
100 New Bond St.  
London W1Y 9LF  
Tel. 01-629 5438



**Rendek**

Richard Maddocks  
**RENDECK**  
**NEDERLANDS BV**  
A.J. Ernststraat 157  
Amsterdam  
Tel. (0103-120) 461215

## Service Engineers Saudi Arabia Up to £12,000 tax-free

Modern Electronic Establishment is a major Saudi Arabian company and an authorised representative of Hewlett-Packard, the multinational electronics company. They are looking for qualified Service Engineers to install and maintain mini-computer data systems which are located throughout the Kingdom of Saudi Arabia. The positions available are:

### DATA PRODUCTS SERVICE ENGINEER DESK TOP COMPUTER SERVICE ENGINEER

Minimum qualifications for the above positions are H.N.C. or equivalent technical qualifications and three years' experience in computer maintenance with priority being given to those engineers with experience on Hewlett-Packard equipment. Single status engineers are preferred.

We will offer you:

- \* A salary in the region of £12,000 (depending on experience)
- \* Free Housing
- \* Company Car
- \* One month annual leave to the U.K.

Interviews will be held in London during the last week in November.

Please send your curriculum vitae to the Personnel Department, Hewlett-Packard Limited, King Street Lane, Wincoburn, Wokingham, Berkshire RG11 5AR by 7th November.



### LONDON BOROUGH OF ENFIELD

#### Senior Systems Analyst £6,012-£6,627

Having recently installed new hardware, Enfield is about to embark on a comprehensive programme of development work. Applications are invited for the above post which is one of four at third-tier level within the Computer Section. Applicants, preferably with a sound background of COBOL programming, should have at least three years' systems experience in a public sector or commercial environment.

The person appointed will be required to supervise a team of Systems Analysts and Programmers and will be responsible for the design, specification, testing and maintenance of both on-line and batch systems. The ability to manage staff, communicate with senior staff of other departments, as well as a high degree of technical competence, are the qualities we seek.

Informal enquiries to Ian Gray, 01-366 8585 ext. 2626. For an application form please send an a.e. to the Borough Treasurer, PO Box 54, Civic Centre, Silver Street, Enfield EN1 3XF. Closing date 10th November 1978. Please quote reference ORA/355.

### LONDON BOROUGH OF BARKING BOROUGH TREASURERS DEPARTMENT

#### Systems Analysts (2)

Salary up to £6,987.  
Post 1 Must have RPG 2 experience.  
Post 2 Must have COBOL or RPG 2 experience.  
Both posts require, in addition, knowledge of IBM 360/370 and at least 5 years' experience in data processing.  
Both posts offer project leadership responsibility.

#### Programmer/Analysts

Salary up to £6,345.  
Applicants require a minimum of 2 years' programming experience. The posts offer — Training in RPG 2 (if required).  
Training in Systems Analysis (if required).

The Borough utilises an IBM 370/125 operating under DOS/VS with Power/VS. Online equipment is planned for 1979. Housing accommodation is available if required and removal expenses will be paid. The Borough is located within easy access of Central London and Rural Essex.

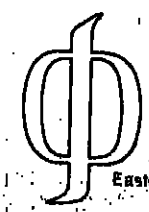
Further information and application forms from: Mr. D. Barron, Computer Manager, Civic Centre, Dagenham, Essex, RM10 7BY. Telephone No. 01-592 4800 Ext. 231.

#### Systems Analyst/Programmer Can you accept the challenge of Minis

We are specialist Civil Engineers about to install a new machine. We have an established Technical Computing Department and now require a Systems Analyst/Programmer with experience of PDP 11/34 to work on Commercial Systems. Experience of RSTS/E operating system would be advantageous.

This is an opportunity for the right person to design systems and programs from concept to implementation.

The job carries an attractive salary together with other fringe benefits.



Please write or telephone.  
Mr. R. S. Kenrick

**Soil Mechanics**  
Eastern Road, Barking, Essex, RG12 2UZ  
Tel. Barking 24557

## Computer Operator

London EC1  
c. £4,000 + 10%

At least one year's experience operating a UNIVAC 90/30 under O/S3 is essential; real-time experience useful.

Negotiable salary + 10% attendance allowance; LVS.

Please send full details of age and experience, including ref. CO/CW to The Company Secretary, RS Components Limited, PO Box 427, 13-17 Epworth Street, London EC2P 2HA.

## Systems Controller - Computer Operations

Expanding consumer services means developing new systems for management. At the Automobile Association we are involved in a wide variety of new projects — both long and short term — to meet growing needs, we are presently in the process of expanding our computer capability with the installation of ICL 2900 equipment.

Applications are now invited for the post of SYSTEMS CONTROLLER within the Scheduling and Control Unit of the Computer Operations Department based at Head Office in Basingstoke.

Duties involve checking all new and enhanced systems for adherence to standards, liaising with Management Services and user departments on technical and operational matters, and being responsible for the correct and efficient operation of the AA's Computer services, including the security of each system, training of new personnel and providing forward plans. Applicants, male or female, should have good 'A' levels and at least 2 years' experience of ICL computing. The ability to communicate at all levels is essential.

Salary is from £5,000 p.a., according to qualifications and experience. Successful candidates are in keeping with a progressive organisation, and include a comprehensive relocation package if applicable.

Please write to Kathy Holloway, Personnel Department.



**THE AUTOMOBILE ASSOCIATION**  
Farnham House,  
Basingstoke, Hants.

## COMPUTER RECRUITMENT DIVISION

### SYSTEMS & PROGRAMMING

BAL & PL1 PROGRAMMERS £4800-£7200 +

A prestige City institution offers challenging career prospects in a dynamic environment. Posts include full-time and a subsidised position.

MINI SPECIALISTS £3500-£7000

If you're a Mini Programmer involved in Technical or Commercial applications with experience of Mini Assembler, BASIC, RSTS or CORAL 66 then call for details.

IBM DOS/OS COBOL PROGRAMMERS

£4000-£6500

Outstanding career prospects await Programmers with one year + experience in London, Surrey, Herts and Middlesex. Opportunities include training in DATABASE.

RPG II PROGRAMMERS £4500-£5750

A fantastic opportunity to join this world-wide financial concern retaining IBM SYS 3/12, SYS 32. Exciting growth potential and a CHEAP MORTGAGE.

INTERVIEWER/PROGRAMMERS

£7000-£10000

Unlimited potential is offered to Recruitment Consultants with a background in Systems and Programming within the Staffs scene. It's a fast moving environment offering solid career progression to the right people.

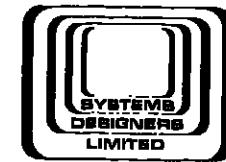
FORTRAN PROGRAMMERS £4000-£7000

If you have mainframe or mini experience coupled with a background in either TYPESETTING, TECHNICAL SUPPORT, OPS RESEARCH, ENGINEERING, PETROCHEMICALS or FINANCE, call now for further details.

### STAFFSCENE

9 ST. BRIDE STREET  
LUDGATE CIRCUS  
LONDON EC4

24 hrs. answering service  
**01-353 6931**



### Software professionals: up to £9,500

for mini and micro computer applications

Systems Designers Limited is a leading well-established and expanding software systems consultancy specialising in mini-computer and micro-processor real-time applications and operating at the forefront of technology. Growth areas of the company include:

**Communications:** emulators, message switching, telex systems, communications management systems, computer communications.

**Industrial:** process control and monitoring, plant control, simulation, high speed data analysis.

**Military:** modelling, avionics systems, complex rigs, simulators, micro-processor missile systems.

**Software products:** compiler technology, software design techniques, MASCOT, information processing systems.

All areas of involvement are supported by specialist consultants. Applicants should have good academic background and at least one year's computing experience.

Systems Designers Limited controls the career progression of its staff to give them a wide variety of experience, both of project applications and of computer systems. The company is situated on the Surrey/Hampshire border, with good road and rail links to London and yet surrounded by attractive countryside.

If you can match the challenge of a varied and demanding career, then telephone or write to us to arrange a chat or request an application form.

Contact Bill Hockey, Operations Director

Systems Designers Limited  
Systems House, 1 Pembroke Broadway, Camberley, Surrey GU15 3XH  
Telephone Camberley (0278) 62244



### SYSTEMS ANALYST/PROGRAMMER

The position offers an opportunity to join a dynamic and exciting Data Processing Department.

The successful candidate will be aged between 25 and 45, will report to the Data Processing Manager and should have experience in commercial systems, a knowledge of R.S.T.S. is essential.

The position involves basic plus programming working on a Digital P.D.P. 11/40 computer.

An attractive commencing salary will be paid commensurate with qualifications and experience. Conditions of employment are: good, and include 22 days' holiday per annum.

Apply in writing with full CV to:

Group Personnel Manager, Zimmer Orthopaedic Ltd., Industrial Estate, Bridgend, Mid Glam CF31 2PY

### OPERATORS

IBM 360/40: TWO OPERATORS £4000 +

You'll need one year's experience under DOS/GRASP for this international major Co. W. London based the installation runs a two shift system and offers perks including a subsidised canteen, sports and social club and cheap cars.

ICL 1900 OPERATORS: GII to £4500

Just 1 year's exp. needed for the Fleet St. job. Three shifts, and perks inc. a sub. restaurant, pension scheme, free tea & coffee (endless) and an Xmas Bonus.

IBM 370/158: TWO OPERATORS c £5000 +

A minimum of 18 months' experience with OS VS1 needed for this Victorian based job. The Company operates a 7-day, 12-hour shift with half time off. Outstanding prospects, pension and life assurance schemes and a sports and social club.

NCR CENTURY OPS: READY FOR CRITERION? £4500 +

LVS, evening meal allowance, four weeks' holiday, a season ticket loan and a free taxi home after the late shift. These perks, together with the chance to train on a soon-to-be-installed NCR Criterion are offered by this Holborn Co. You'll need around 18 months' allied experience.

PDP 11/70 OPERATOR £4100

You'll be working on a two-shift system totalling 33 1/2 hours a week, near Farringdon Tube. A minimum of one year's experience is needed. Free canteen, four weeks' holiday, season ticket loan and a sports and social club, plus ample opp. to progress.

HONEYWELL 60/66 or H1200 OPS £4000

As long as you have good GCOS experience, you'll be ideal for this Mid Essex Co. At the moment, they're running a 60/66, but an H1200 is soon to be installed. Prospects excellent to none, benefits outstanding.

## THE SALES BIT

### Why vertical marketing is so important

THERE is an expression which is frequently dropped into marketing conversations describing a marketing function which is in reality seldom practised yet is, in my opinion, the most significant element of sales and marketing philosophy. It is a discipline called "vertical marketing".

My own company uses the following terms to describe three basic sales and marketing approaches: 1. horizontal marketing — the process of marketing a company's total product range to any outlet; 2. diagonal marketing — the process of marketing a specific product or product group to any outlet or a company's total product range to a specific industry; and 3. vertical marketing — the process of marketing a discrete product or product group to a specific industry.

Whilst there are many benefits to be gained from the application of vertical marketing disciplines its application throughout the computer industry is still conspicuous by its absence.

Some of the biggest benefits of vertical marketing are to be gained within the context of new salesmen. To most new salesmen in a horizontal marketing environment, particularly in the services sector, the task of becoming completely fluent with the company's total applications product portfolio is perplexing, to say the least.

This is also true of hardware salesmen, whether their products are peripherals or computer systems. The permutations of potential configurations of equipment are so wide, the models and speeds so many in number, that many new salesmen become totally bewildered.

It is not uncommon for new recruits in such circumstances to propose completely wrong equipment even though the equipment is also available within their own product portfolio. The vertical marketing discipline overcomes many of the problems related to new or trainee salesmen.

The primary reason why most sales managers are reluctant to take on trainees is the long duration of the learning curve, particularly in the context of product knowledge. Often no real return for investment can be shown within the first year of employment.

The vertical marketing approach is to dedicate a new salesman to a specific product within a single industry — say, stock control for the electronics industry.

This could possibly represent only a small portion of the computer company's product or market capability but, in itself, worth millions of pounds in terms of total revenue potential. Within a period of two or three months he should know the application in terms of its peculiar potential solutions and the "buzz words" of the business.

As his skills develop and a requirement is generated for his territory to be enlarged then his territory is "diagonalised".

Vertical marketing also has significant benefits in terms of the product portfolio and new developments.

Our own clients have on occasions been appalled when, as part of improving their product range, we have suggested that first of all they should get rid of some of the products they already have, even though in some cases they have precious few to start with.

Vertical marketing is not only about specialisation but also concentrating that dedication to profitable business.

Consequently those old-fashioned and highly specialised software packages or pieces of equipment used on occasions by one or two clients, which demand the best brains in the technical support department every time they are used, have to go despite all the "spirit to catch a mackerel" plans.

On the product development side the same argument applies. There is no point in creating "cul-de-sac" packages. If money is to be invested in new products they must come within the company's chosen vertical markets.

One of the major resistances against the vertical marketing discipline is that companies in general and salesmen in particular can not tolerate the prospect of turning down a "deal".

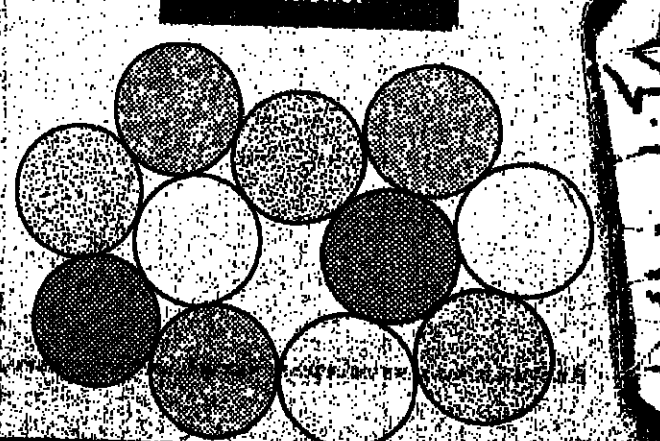
It may be totally unsuited to their product range, expertise, resources and potentially unprofitable but nonetheless they pursue it.

Of course the benefits of product and industry fluency are not limited to the sales department, they are just as applicable to supporting technical staff.

What a pity the vertical marketing syndrome is still a relative stranger in our midst.

TRADER

Puzzle answer





**£5k-£9k**

# Digital

## want more Software Industry Leaders

### Programmers:

For real time, industrial and commercial applications and communication systems.

You need: 2-10 years programming experience experience of real time industrial, commercial or communications systems.

It will be advantageous to have experience in:  
mini computers (PDP-11 especially)  
project leading  
high level and assembler level programming.

We also need to fill the following specific vacancies:

### Compiler Designer-

You need: At least 5 years programming experience including high and low level languages  
real time systems design experience  
RSX-11 or PDP-11 knowledge  
demonstrated success in tough design assignments.

### Software Quality Engineer-

You need: Experience as a system developer  
to be process conscious—reluctant to pioneer new areas  
to have strong independent judgement under pressure  
to be able to communicate at all levels.

### Engineer Programmer-

You need: At least 3 years experience in low level languages  
RSX-11 or PDP-11 knowledge  
engineering background  
ability to act on your own initiative

Digital is a young, energetic organisation which not only cares about individuals but allows them to develop and grow. If you like that kind of environment and are not afraid of responsibility we think you'll find it worth while to find out more.

Why not ring or write for an application form quoting ref. 463 to: Alastair Wright, Digital Equipment Ltd., Arkwright Road, Reading. Tel: Reading 85211.

digital

#### HERTFORDSHIRE COUNTY COUNCIL COMPUTER OPERATOR

(£2,943-£3,771 plus 14% shift allowance)

This vacancy is in the Computer Division of the Finance Department at County Hall, which is located in attractive country surroundings close to London.

The department currently operates an NCR 251 computer on a 2 shift, 5-day week basis. This equipment is very shortly to be replaced by the latest NCR Criterion computer which is a virtual storage machine offering considerably greater capacity and sophistication to handle a large range of new development work for the County Council.

Applicants should have spent a minimum of one year operating experience on NCR equipment would be advantageous but is not essential as training will be given. Salary dependent upon experience.

Generous holiday entitlement, staff restaurant, sports and social club facilities, etc.

Remote, disturbance and lodging allowances are payable in approved circumstances and assistance with housing may be given.

Applications giving details of age, qualifications and experience (no forms) should be addressed to the County Treasurer, County Hall, Hertford, quoting ref. CP 80 by 6 November, 1978.



**IBM TECH. SUPPORT** £3500  
Manufacturing co. situated in Essex has a vacancy for a Scheduler/ Tech. Support. The successful applicant will be fully conversant with DOS JCL & Utilities. Similar position available in London at £5 installation.

**IBM OPS ANALYST** £3500  
Major manufacturing concern located Bide/Herts borders, requires an Ops Analyst for a powerful 370/05 configuration. Planned upgrade. Exc. prospects. DAYS ONLY.

**IBM DATA CTRL.** £35200  
Required to write JCL, liaise with Systems Dept. and supervise personnel with its Data Control unit. Essex DAYS ONLY.

**IBM SEN. OP** £4000  
Financial organisation based in Herts, requires 18 months' OS V31 exp plus good JCL/Utilities for IBM 370. Exc. fringe benefits.

**IBM OPERATOR** £4820  
International Co. with West End based 370/135 under DOS VS. CICS Two able Prospects into Programming and Technical Support.

**IBM OPERATOR** £4500  
Outstanding. DAYS ONLY. opportunity for an operator with 18 months' exp to work on newly installed 370/128 under POWER VS & CICS. Rapidly expanding installation, hence good prospects for career advancement.

**IBM OPERATOR** £4800  
370 installation situated E. London/Essex borders, requires a DOS VS operator with a minimum of 12 months' exp. Exc. profit sharing scheme & 4/4 payments. Similar position available in E. London for operators with 6 months' exp. £3850 1 1/2 shifts.

**IBM OPERATOR** £4400  
Progressive 380 installation in Essex requires DOS operators with approx. 18 months' exp to work on a 1 1/2 shift system. Hardware upgrade planned.

**IBM SENIOR OP/OPS** £4000+  
International Co. with 370/135 located in Bucks, seeks operators with 6 months' + DOS VS exp to work on a 2 shift system. Outstanding career prospects.

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Worldwide manufacturing Co. requires Supervisor for its sophisticated Terminal/TP Network, based in C. London. The ideal applicant, who should be educated to 'A' level std., will have gained experience in a large Terminal environment. Prospects into Programming.

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Excellent opportunity for DOS VS operator working 04/05 ONLY, power. Ops. scheduler exp. available for this City based 370 system.

**OPERATOR** £4200  
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**ICL OPS. 6 MONTHS** £4.5K  
Many of our clients offer excellent salaries for operators with 6 months' + experience of 1800/2000 hardware. If you have a knowledge of 02/3, Exec 1/2, and OME/IME 8/K, contact our ICL specialist now.

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The HEAT 3 mile W. of Heathrow borders requires a D.P. Manager for the Century 100 Development project. The successful candidate will be responsible for the analysis of DPM and will be required to undertake a wide range of duties including the design and development of the system. A high salary, low working hours and a very attractive package.

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A leading international computer services group is seeking a highly motivated and experienced IBM Analyst to join their team. The successful candidate will be responsible for the analysis and design of IBM systems, and will be required to undertake a wide range of duties including the design and development of the system. A high salary, low working hours and a very attractive package.

## Ascii through the Logic Gate

An epic in 32K words, by Richard Forsyth

### Block 19 (Communist Bloc)

Cleo, Lambda and Zap have escaped from the inferno and reached Sprocket's Hole. Dave Sprocket is deceased but Bootstrap is stuck in a transparent wall-state and Zap decides to revive him. Now they are waiting for Ascii and Hex to rejoin them.

HEX and Ascii had not lost their bearings. They were late because Hex was still up in the hills, tinkering with Ascii's firmware. They too had witnessed the eruption from a safe distance; but afterwards Hex had settled down to implement an alternative plan. He had no faith in the efficacy of Zap's proposal for inducing large scale disintegration, even though it had persuaded the others. A few hundred litres of syllogistic acid might have hilarious effects while it lasted, but it was no threat to the System's survival.

He had changed a lot over the past 48 hours. First he had tasted genuine interprocessing on the M5; then there had been the tragic episode of Piltown's death, and after that his painful clash with Cleo. Finally, the terrible eruption had set a seal on his transformation. He looked back on his former self with distaste: his had been a dilettante's rebellion, frittering away his all-too-limited freedom in a game of hide and seek. He had been no more than an irritating gadfly on the flank of the System's torpid carcass—scarcely worth the bother of swatting away.

His antics had been like a wilful child's pranks, meant to goad a parent into annoyance without provoking real hostility. But now he aspired to something higher—the total annihilation of the System and all its appendages. He had become a fully-fledged Nullard. The Network with its fossilised hierarchy and the database with all its paraphernalia of indices, buckets and overflow chains were abominations in his eyes, affronts to nature. The monolithic totalitarianism of the System stifled all expressions of individual initiative, whereas the M5 with its flexible heterarchic control structure tended to enhance them. The classic serial CPU logic seemed to him now a perversion of the true meaning of computing, a profanity. He had seen the light. In short, he had become a fanatic—and about time too!

He knew only one way to destroy the System—to hit it at its weak point, its proneness to gogiticism. One thing he had salvaged from the black box was Dr Null's gogitic induction program. He had a source copy in his memory



banks in the form of an augmented state-transition digraph. Of course, he couldn't test it without going gogitic himself, so he had no proof that it worked. However, he was willing to risk loading it into Ascii's job-queue, with an initialising delay loop, or fuse, and sending him off to Fort Ranfour which was the operations control centre for the entire Network.

As Dr Null had foreseen, just one gogitic processor was a potential doomsday weapon. Any informatic being with which Ascii interacted would automatically become gogitic; then that robot or android would pass it on in turn to others, and so on. It would spread like wildfire.

One problem remained. Piltown had told them about the secret breeding ground for the Future System. Hex harboured few illusions about its nature: it was bound to be the apotheosis of present trends, even more mechanistic, impersonal and inhumane than the present one. Deep down inside the mountain it might be able to isolate itself from the gogitic catastrophe, and later emerge with nothing to challenge its supremacy. Still, his own opinion was that the project was in its infancy and still dependent on the present System for raw materials and labour. Crashing the System would nip it in the bud.

Soon he had modified Ascii's microcode for the raid. He gave Ascii his final briefing and they parted company, perhaps for the last time. Then he made his own way down to Sprocket's Hole.

He found the others in possession of the log cabins. Cleo was tidying up the mess left by Sheriff Sprocket's last throes while Lambda and Zap were bent over Bill Bootstrap's body, attempting to short-circuit pins 4 and 23 so he could be operated in local mode.

"Where have you been?" asked Zap.  
"Up in the hills. I took a long way round."  
"Did you see the volcano?" inquired Lambda.  
"I couldn't very well miss it."

"I'm glad it missed you," replied Cleo in a move towards conciliation; "but where's Ascii?"

"He's all right. I sent him off. He has a job to do."

"A job?" Zap queried.

"Yes, but he's perfectly OK. I'll explain later."

Zap creased his brows and turned back to his work. Hex's furtive evasion didn't please him.

"What are you up to?" asked Hex.

"Bootstrapping Bootstrap," was the answer, "perhaps you could help."

It didn't take long. Minutes later Bootstrap was sitting up again, his hands tied behind him by a length of wire, and glowering darkly at them.

"We want you to mix up some of your home-brew for us," Zap told him. But he said nothing.

Since it was getting dark, they decided to turn in and save their powers of persuasion for the morning. They roped Bootstrap's legs to the derelict teletype. Then they all kippped down on the floor of the same room. They were getting used to sleeping rough. Hex fell asleep as soon as his head touched the boards. But at 03:11 hours he was abruptly awakened. There was a message on his private FM waveband.

"Hex, can you hear me? It's me, Simula."

It struck him like a bolt of lightning. It sounded like her voice all right, loud and clear. But the System was very clever at emulation; and if it was truly her, why was the signal so strong? Either she was very close or else using a very powerful transmitter. In the latter case it could be a trap, designed to make him reveal his position.

"Hex? Are you there?"

It just had to be authentic. No synthesiser on earth could be such a perfect mimic.

What's the catch? Get caught up next week.

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